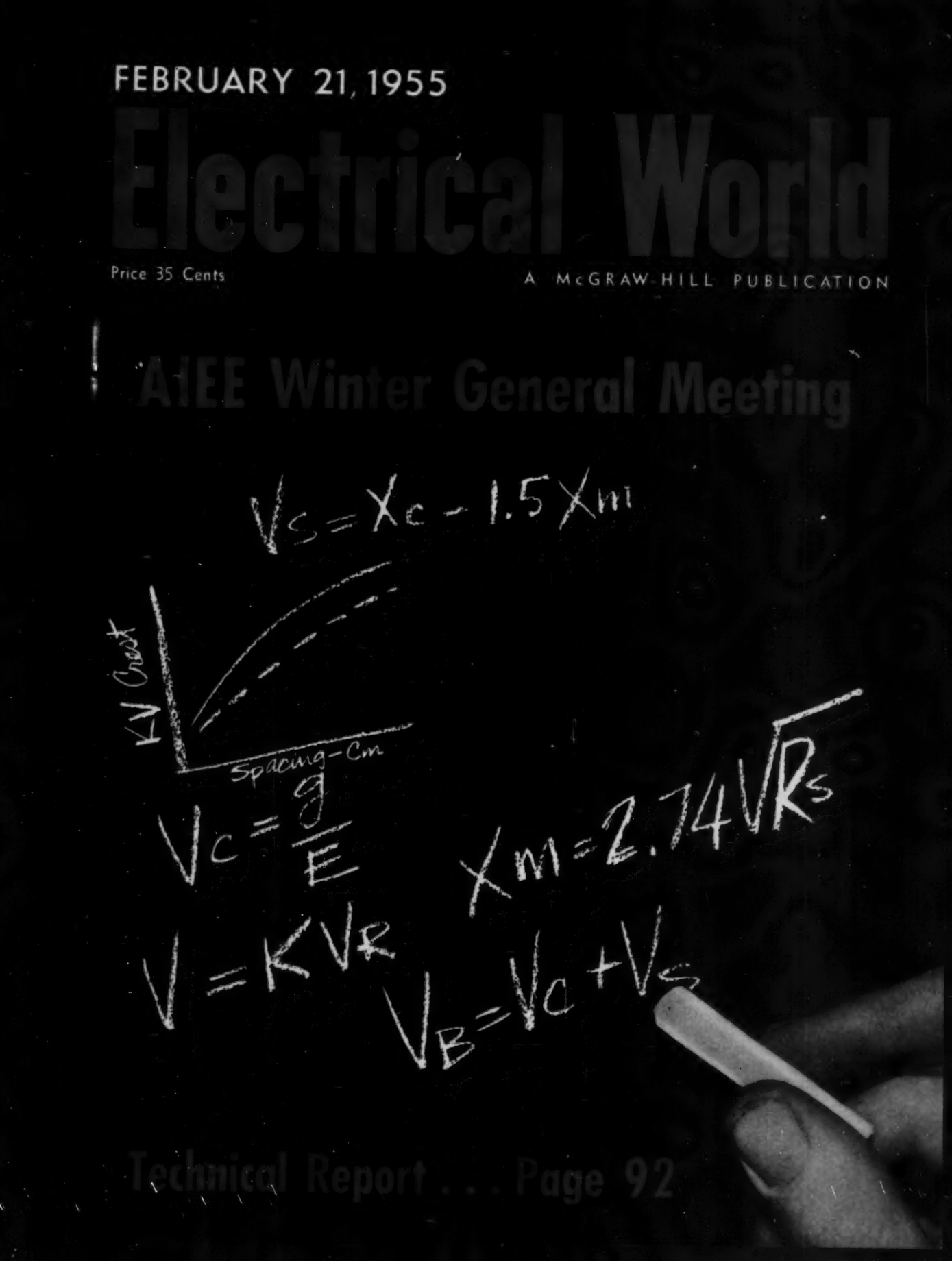
FEBRUARY 21, 1955

# Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

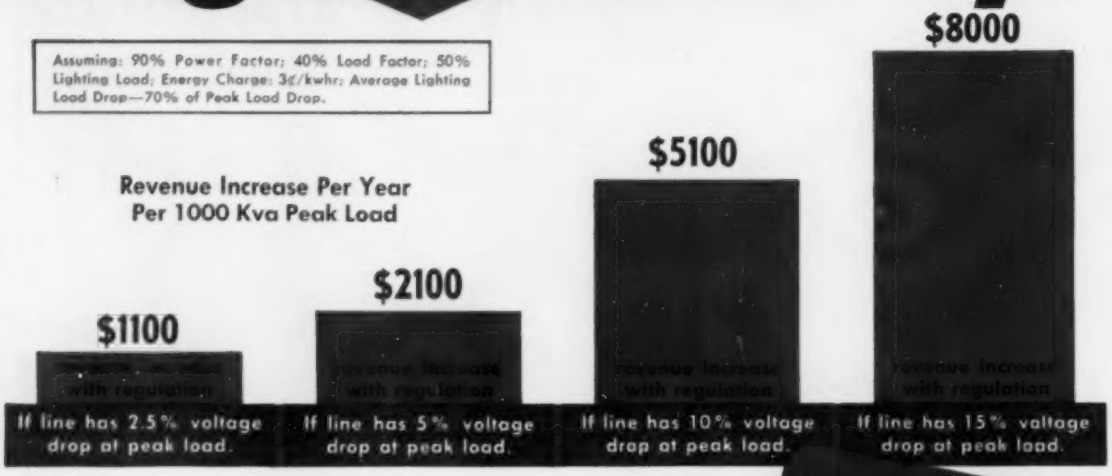
## AIEE Winter General Meeting




Technical Report . . . Page 92

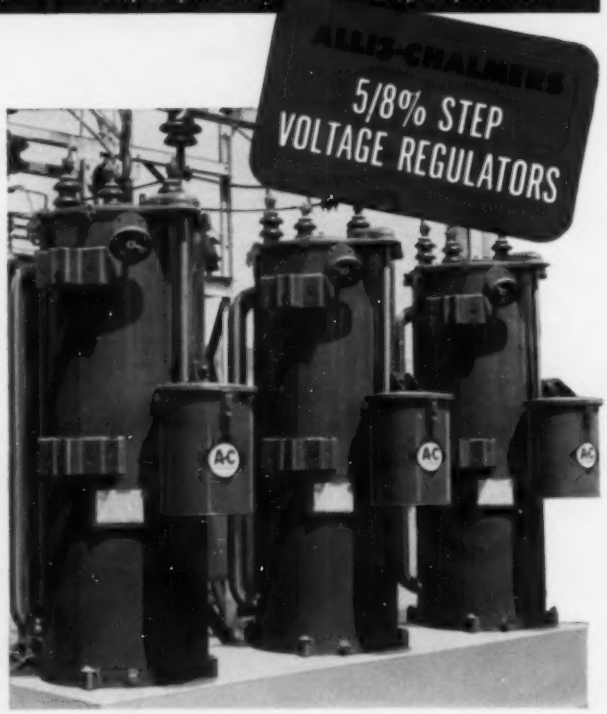
# These Figures Prove
# Regulation Pays

Assuming: 90% Power Factor; 40% Load Factor; 50% Lighting Load; Energy Charge: 3¢/kwhr; Average Lighting Load Drop—70% of Peak Load Drop.


Revenue Increase Per Year
Per 1000 Kva Peak Load
$1100
$2100
$5100
$8000
Revenue increase with regulation
If line has 2.5% voltage drop at peak load.
If line has 5% voltage drop at peak load.
If line has 10% voltage drop at peak load.
If line has 15% voltage drop at peak load.

You can increase revenue $2100 the first year with an Allis-Chalmers distribution regulator. That's on a line with only 5% low voltage at peak loads. This increase is more than the regulator costs. Taking all cost factors into consideration, it's enough to pay back initial investment in two years or less, in most cases.

You improve your maintenance picture too, with Allis-Chalmers distribution regulators. Since complaints due to low voltage will be greatly reduced (some operators report them eliminated!), service crews and equipment can be used where they are really needed. No more time and money wasted testing voltage at customers' homes.




### Low Maintenance, Long Life

Hundreds of distribution engineers will tell you that when you specify Allis-Chalmers voltage regulators you get a unit that requires minimum maintenance, gives longest possible life. For example, the mechanism is laboratory tested to withstand 5 million operations. More than 20 years of field operation have added operating proof to these tests. No other 5/8% step regulator offers successful service records like these.

Get more information from your nearby A-C district office on how Allis-Chalmers distribution regulators can make your system pay off with more revenue, more profits. Or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4566

# ALLIS-CHALMERS

A-C ALLIS-CHALMERS

# Electrical World

Vol 143 No. 8 February 21, 1955

**EDITORIALS**—Pertinent comment on the industry's problems and accomplishments ... 83

**THE ELECTRICAL WEEK**—Last minute news briefly told ... 84

**NEWS**—Complete coverage of activities affecting the industry ... 86

FEATURES:

AIEE WINTER GENERAL MEETING REPORT ... 92

SYSTEMS EQUIPMENT TESTS FACILITATED ... M. A. Fredrickson 104

IRVING TRUST RUNS FINANCIAL SEMINAR ... 105

FOR 300-KV LINE ALCAN IS SOLD ON ALUMINUM FOR TOWERS ... 108

GROUND VIBRATIONS PIN POINT FAULTS ... C. B. Bechtel 114

**HOW TO**— Practical ideas for those who design, construct, operate, and maintain ... 119

**INDUSTRIAL APPLICATIONS**—Successful applications of electricity in industry ... 148

**SALES AND SERVICE**—Commercial, rural, and residential uses of electricity 158

**MANUFACTURERS & MARKETS**—Information on electrical manufacturers and today's markets ... 177

**NEWS ABOUT PEOPLE**—Personnel changes throughout the industry ... 182

**FINANCE & REGULATION**—Securities and financing news ... 200

**STATISTICS**—The industry's progress in figures ... 203

• • •

Engineering Reference Sheet .. 126
New Equipment ... 162
Catalogs and Bulletins ... 170
Technical Literature ... 171
Books ... 172
Meetings Calendar ... 186
Index of Advertisers ... 193
Public Relations ... 196
Readers Forum ... 197
Technical Notes ... 198
Washington Comment ... 198

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

FISCHER BLACK, Publisher and Editor
JESSE MOCK ... Asst to the Editor

DANIEL T BRAYMER ... Managing Editor
LEONARD M OLMSTED ... Associate Editor
KENNETH K KOST ... Associate Editor
HERBERT R FRANKEL ... Associate Editor
RUE M SHOOP ... Associate Editor
GEORGE SWIFT ... Associate Editor
V CRAIG RICHTER ... Associate Editor
EDWARD ALLEN ... Midwestern Editor
HOWARD S KNOWLTON ... New England Editor
JOHN J KEARNEY ... Middle Eastern Editor
FRANCIS KOVALCIK ... Western Editor
DAVID REA ... Northeastern Editor
JEANNE BERNHARDT ... News Editor
IRIS ST. CLAIR ... Departmental Editor
E BRYSON SESSIONS ... Assistant Editor
ALLEN LONG ... Assistant Editor
ARY MOSSIMAN ... Manager of Market Research
JOAN STEEN ... Statistician
W J WALLACE, JR ... Art Director
DENISE HENNESSY ... Production Editor
G B BRYANT, JR ... Mgr. Washington Bureau
W. GILMOUR ... Washington Correspondent
DEXTER M KEEZER ... Dir Economics Dept
RICHARD W EVERETT ... Economics Dept
A E KNOWLTON ... Consulting Editor

DOMESTIC NEWS SERVICE: Atlanta, Chicago, Cleveland, Detroit, Houston, San Francisco.

WORLD NEWS BUREAU: John Wilhelm, Editor, Bonn, London, Mexico City, Paris, Sao Paulo, Tokyo.

WARREN W SHEW ... Sales Manager

DISTRICT MANAGERS: E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; E S Chapin, Detroit; W H Meneilley, Chicago; J T Schaefer, St. Louis; C W Dysinger, Los Angeles; R C Alcorn and T H Carmody, San Francisco; William Lanier, Atlanta; James Cash, Dallas.

OTTO DRECHSEL ... Business Manager

ELECTRICAL WORLD

Published weekly by McGraw Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office, 99-129 N. Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office, McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y.** Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

**Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.**

**Subscriptions are accepted only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.**

Single copies 35c. For the United States and possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 28, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Copyright 1955, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

INDOORS

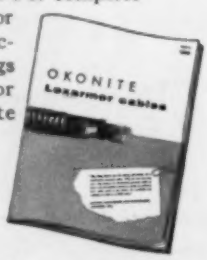
OUTDOORS

# rubber-insulated **LOXARMOR CABLES** save space, reduce cost

Considerable interest is growing throughout industry in Loxarmor (interlocked armor) Cables for use in locations where the maximum protection of a rigid conduit is not required. Okonite's interlocking Loxarmor covering makes the cable flexible and easy to train (minimum bending radius 8 times cable O.D.) and at the same time provides mechanical sturdiness. Installation costs are lower than for rigid conduit systems, and Loxarmor's accessibility makes it easier and cheaper to reroute or add circuits. Its compactness provides important space-saving features where runs must be installed around existing plant equipment. Loxarmor coverings can be supplied in galvanized steel, aluminum, bronze or copper.

Okonite rubber-insulated Loxarmor Cables are insulated with Okonex, a butyl-base compound applied by Okonite's famous strip-insulating process. Vulcanized in a metal mold, the insulation forms a solid dielectric wall which has better moisture resistance and electrical properties than laminated varnished cambric insulations. The superiority of Okonex is indicated by its higher insulation resistance, lower dielectric loss, lower power factor and lower specific inductive capacity.

Okonex-insulated Loxarmor Cables are suitable for operation up to 15,000-volts and at conductor temperatures up to 85C. For complete information on Okonite Loxarmor Cables, including detailed splicing and terminating drawings and instructions, write for Bulletin EW1090. The Okonite Company, Passaic, N. J.

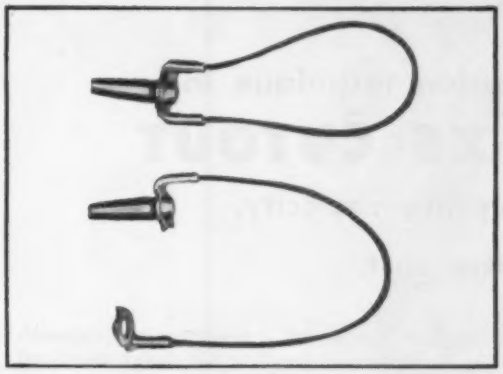


**OKONITE** SINCE 1878 ***insulated cables***

2976

# Electroline AUTOMATIC DEAD-END

## for Neutral Supported Multiple Conductor Service-Drop Cable



THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

**THE ELECTROLINE 3800 SERIES** Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

**ELECTROLINE 4000 ANCHOR BRACKET** — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

***WRITE FOR NEW BULLETINS FOR FULL INFORMATION***

**Electroline Company**

4121 South La Salle Street • Chicago 9, Illinois

In Canada: POWERLITE DEVICES, LTD., TORONTO

# A new cutout with HEAVY-DUTY PERFORMANCE that meets Standard Duty budgets

## New circuit interruption technique in S&C's TYPE XS CUTOUT increases interrupting capacity, but not the cost.

Designed to meet the higher fault currents of today's distribution systems, the S&C Type XS is a standard-duty cutout with respect to distribution economics, but a heavy-duty cutout in its interrupting capacity. It has interrupting ratings which conform to those established by NEMA for certain heavy-duty cutouts—hence the XS may be applied wherever you need an open cutout.

An ingenious "recoil mechanism" is the heart of the Type XS Cutout. It presents a new approach to the problem of handling the energy associated with circuit interruption.

It makes heavy-duty performance possible without resorting to the methods used conventionally for increasing cutout capacities—heavier construction, larger bore, and double venting — methods which not only increase costs but usually sacrifice low fault current protection.

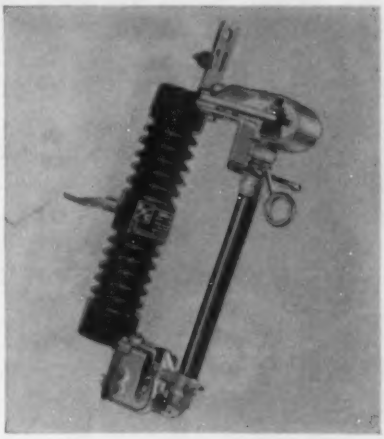
### COMPARE THE CAPACITIES

The XS has an interrupting rating of 5,000 amperes (7.5 kv) and 4,000 amperes (15 kv) as compared to other standard-duty cutouts which are rated 2,000 amperes (7.5 and 15 kv).

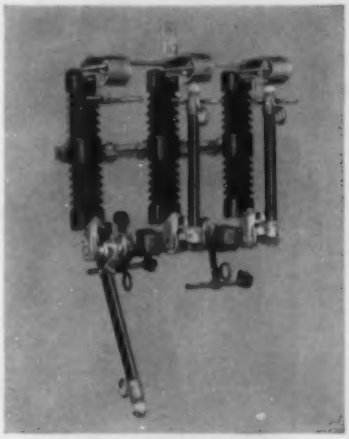
MODERN IN CONCEPT

MODERN IN DESIGN

MODERN IN APPLICATION



S&C TYPE XS CUTOUT
single-shot, birdproof



S&C TYPE XS CUTOUT
three-shot, birdproof

# THE TYPE XS CUTOUT

## offers added advantages by eliminating:

√ the time-consuming operation of short-circuit zoning analysis to determine whether a standard-duty or a heavy-duty cutout is needed in each particular location.

√ ordering or stocking two types.

√ carrying two types of cutouts in service trucks.

√ the worry about construction crews installing the wrong cutout or tube at protection points.

*Complete information on the Type XS Cutout is contained in new Catalog Section 511 . . . we will gladly send you a copy.*

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

IN CANADA:
S & C ELECTRIC CANADA, LTD.
8 Vansco Road, Toronto 14, Ontario

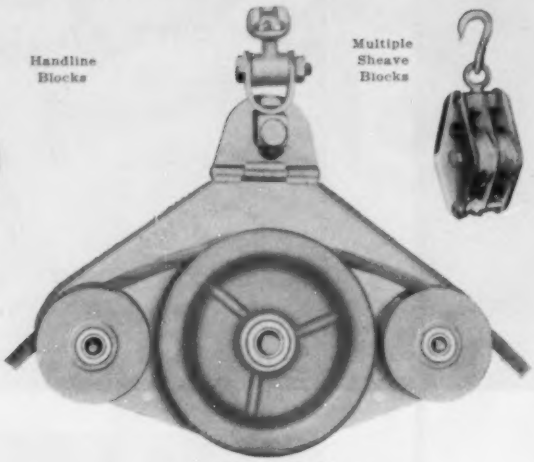
POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

*Specialists in High-Voltage Circuit Interruption*

# CAMPBELL ELECTRIC UTILITY BLOCKS

Stringing Blocks
14 sheave sizes. All wire sizes.

Handline Blocks

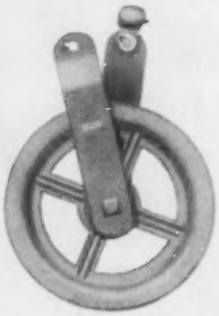


Stringing Blocks,
Tandem Sheave Type with large bending radius.
(Shown with front removed.)

Multiple Sheave Blocks

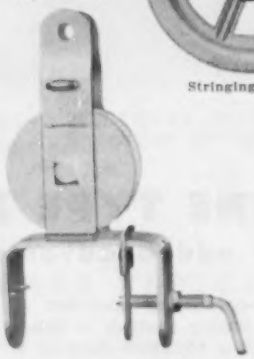
Aerial Cable Blocks. Available in several sizes with regular radius and Parabolic Groove.

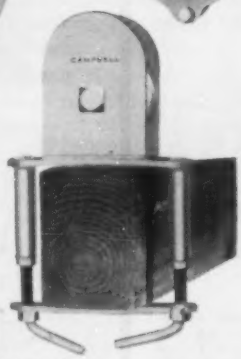
Static Blocks



Stringing Blocks

Snatch Blocks





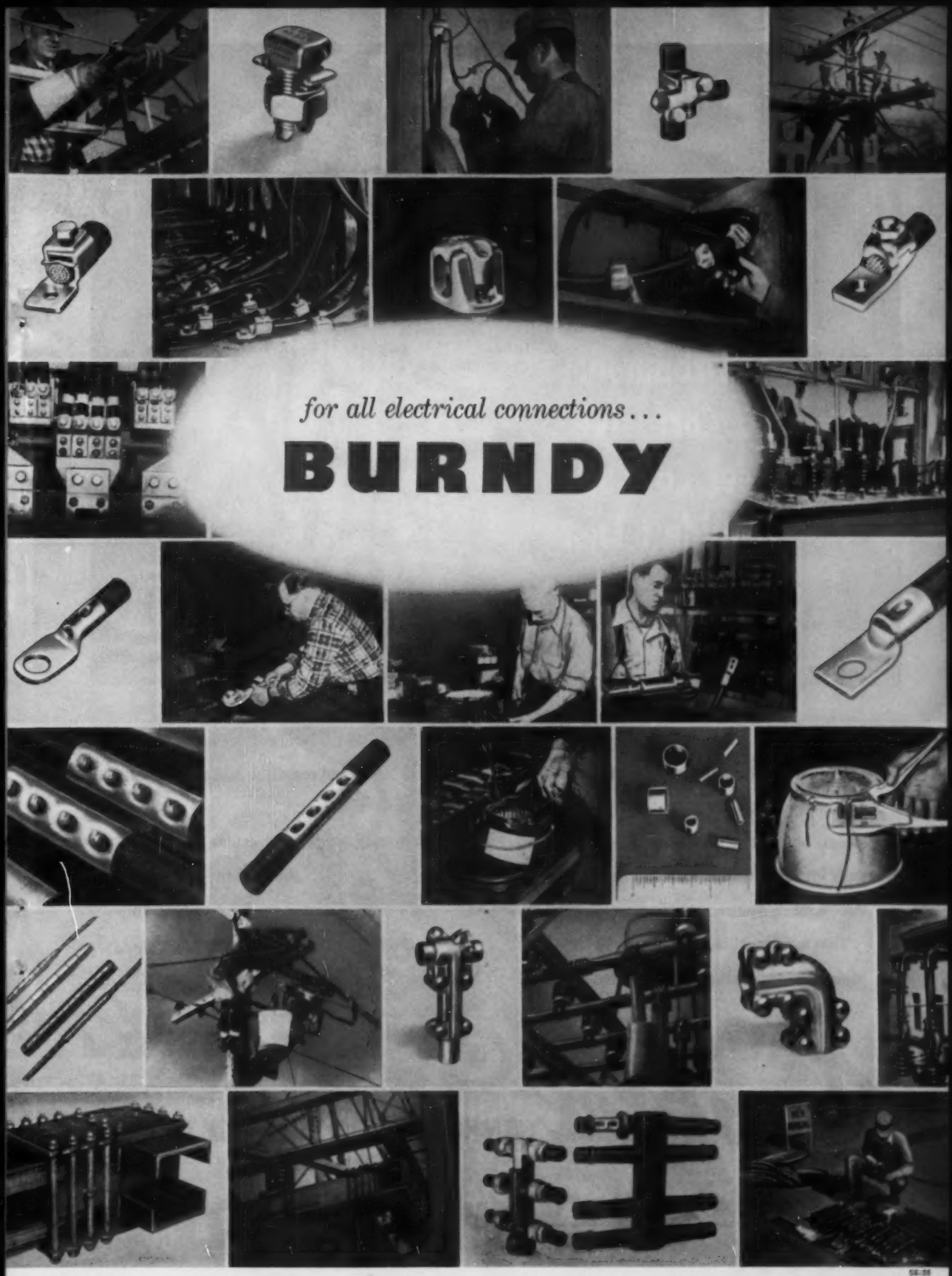
Cross Arm Dollies in Many Styles and Sizes.

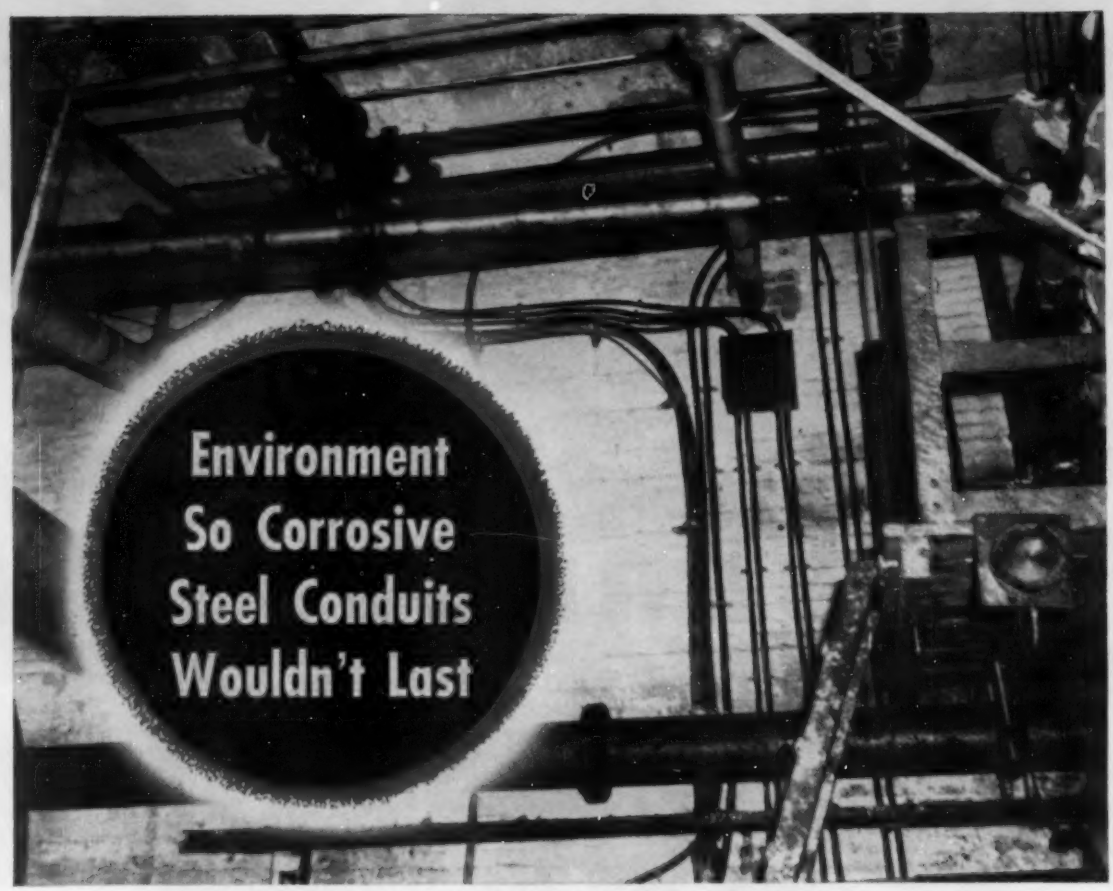
## Campbell Specialty Company

Established 1934

OKMULGEE, BOX 206, OKLAHOMA

Manufacturers of the most complete line of electric conductor conveyors consisting of Suspension Type Blocks, Crossarm Type Blocks, Aerial Cable Blocks, Multiple Sheave Blocks, Handline Blocks, Angle Blocks, Snatch Blocks, "A" Frame Heads and special blocks to order. Blocks are equipped with our pressure cast aluminum alloy or steel sheaves which are available in many sizes for all conductors. Write for illustrated catalog.


for all electrical connections...
BURNDY




Paper mills are notorious for the difficult operating conditions they pose for electrical wire and cable. Caustic soda, liquid chlorine, steam, hot water, all these and more are the daily lot of the wire and cable illustrated. Even steel conduit disintegrated in a couple of years.

That's why this paper mill in northern Maine decided to clip these Anhydrex-insulated cables directly to the walls. They knew these Simplex cables would resist the action of acids, alkalies, water and heat.

These Anhydrex-insulated cables have now been in operation for more than ten years without time off even for good behavior. Can you say the same about your power and control cables? Would you trust your present cables to operate your plant under the same conditions?

**Simplex ANHYDREX-INSULATED CABLES**

**SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.**

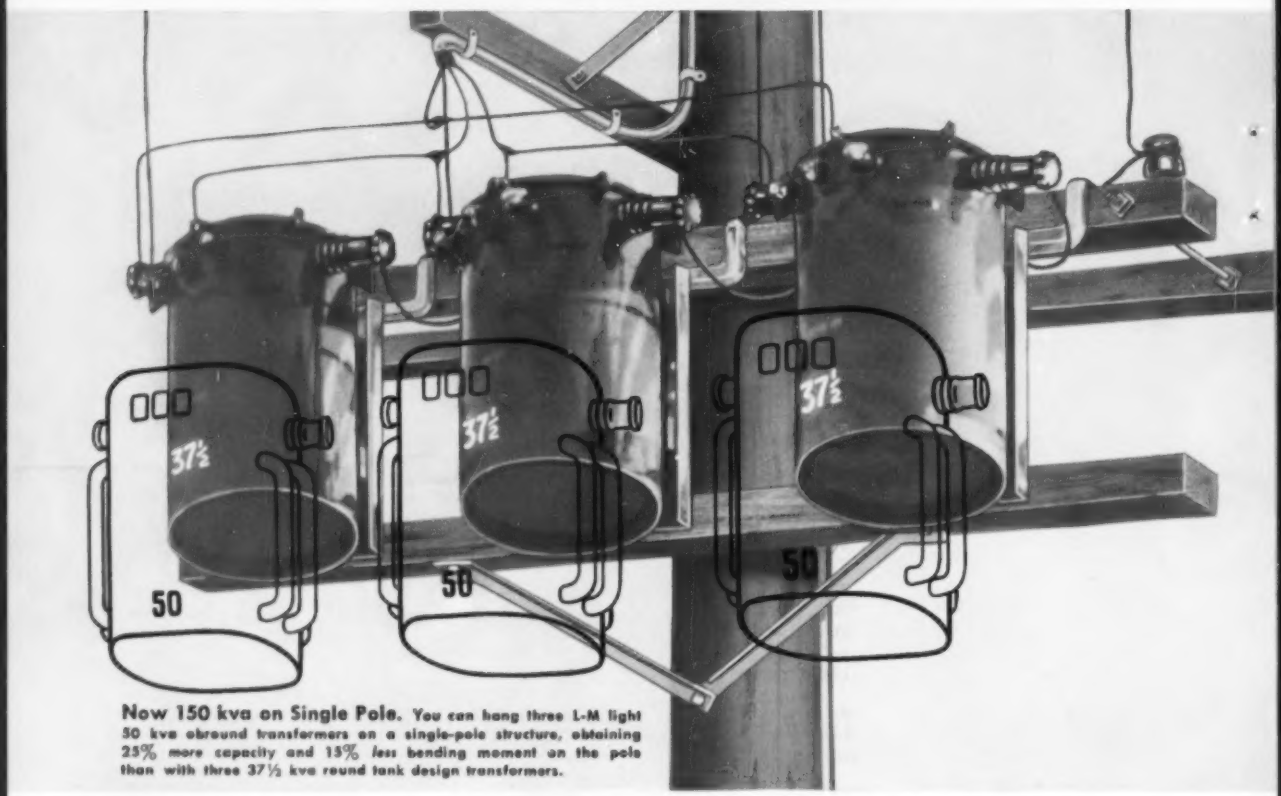
**L-M brings you obround**

with outstanding advantages for overhead distribution

**LINE MATERIAL company**

# How L-M Obround Design Provides Additional Capacity On Structures

**New obround tank design is smaller, lighter, and has shorter moment arm, retaining all outstanding Round-Wound® performance characteristics.**




**Now 150 kva on Single Pole.** You can hang three L-M light 50 kva obround transformers on a single-pole structure, obtaining 25% *more* capacity and 15% *less* bending moment on the pole than with three 37½ kva round tank design transformers.

By **ALVIN B. COYLE**
Manager
Transformer Sales
Line Material Company

Now you can hang transformers of larger capacity on a pole structure with L-M's lighter, smaller obround transformer tank design. The additional capacity is obtained without changing outstanding performance characteristics of L-M's Round-Wound design.

### Less Weight

The obround design provides a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where necessary to provide the cooling surface for maintaining the same low hot-spot and top oil temperature-performance characteristics found in all other L-M transformers. In addition, the transformer's repetitive overload capacity is improved as the result of the faster transfer of heat from the coils to the cooling air.

### Shorter Moment Arm

L-M's new obround design brings the center of gravity closer to the pole, which reduces the moment arm distance from the pole. The combination of lighter weight and less moment arm distance substantially decreases the total bending moment on the pole and crossarms, and thus greatly increases the potential capacity of all your transformer structures.

You can take advantage of savings such as these:

Larger transformers can be hung closer to the top of the pole, eliminating the need for a higher pole and additional spacing.

Single-pole, three-phase transformer structures can now serve more load with the additional transformer capacity available. New 50 kva obround transformers have less bending moment on the pole and on crossarms than previous 37½ kva round tank design. Here L-M's light obround transformers may eliminate the need for costly two-pole structures.

### Pole-Mounted 167 kva Transformers

L-M's light-weight 167 kva transformer can be pole-mounted; provides a full 167 kva of capacity on a single-pole structure. And it, too, provides L-M's well-known overload capacity.

To serve three-phase loads you can hang three L-M light 167 kva transformers or 500 kva on a two-pole structure, eliminate expensive platforms, ground pads, or vaults in many instances, and make further use of existing facilities.

L-M's light, obround design transformers are available in single-phase 5 kva through 167 kva in each standard distribution voltage class.

See performance characteristics and design features on opposite page.

**LINE MATERIAL** Transformers

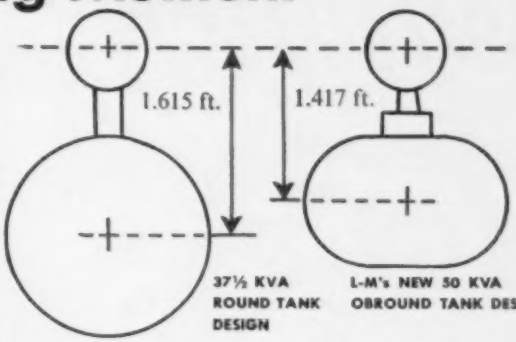
# You Can Hang 25% More Capacity With 15% Less Bending Moment

**COMPARE** 37½ kva round tank design
50 kva L-M obround tank design

**37½ kva ROUND tank design:**
Moment arm from center of pole. 1.615 ft.
Weight . . . . . 800 lbs.
Bending moment 800 x 1.615 . . . . **1292 ft.-lbs.**

**50 kva L-M OBROUND tank design:**
Moment arm from center of pole. 1.417 ft.
Weight . . . . . 775 lbs.
Bending moment 775 x 1.417 . . . . **1098 ft.-lbs.**

L-M's new 50 kva obround transformer has 15% less bending moment than the 37½ kva round tank design.




**Less Bending Moment**—New obround tank design reduces the moment arm distance from the pole. The combination of lighter weight and smaller moment arm distance greatly decreases the total bending moment on the pole. When crossarm mounted, the lighter weight substantially reduces the bending moment on the crossarms.

**Less Weight, Faster Cooling**—The obround design affords a small tank and less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide sufficient cooling surface.

In addition, oil ducts, located throughout the coil and between the coil and cruciform cross-section of the wound core, contribute to uniform efficient cooling.

Rapid transfer of heat provides faster cooling of the unit, increasing its repetitive overload capacity.

## Plus Outstanding Round-Wound Performance Characteristics

Both the physical and performance characteristics of L-M's obround tank transformer were considered in detail. The advantages of lighter weight and shorter moment arm were accomplished with no sacrifice of outstanding Round-Wound performance characteristics.

**Low Exciting Current:** the continuously wound core of oriented-grain silicon steel strip provides a uniform flux path, thus permitting low exciting current.

**High Impulse Strength:** high-voltage windings are on the outside of the coils, providing maximum distance between the high-voltage windings and the core. This permits ample creepage distance with generous insulation.

**High Short-Circuit Strength:** round coils naturally resist radial short-circuit forces without damage or distortion. Sturdy core clamps and strong blocking aid in preventing axial movement of the windings under short-circuit conditions.

**High Short-Time Overload Capacity:** cruciform cross section of wound core and ducts between windings and layers provide excellent cooling for the entire unit.

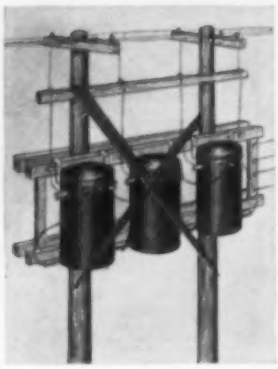
Now you can hang 167 kva directly on the pole, yet L-M's new lightweight obround has full 167 kva continuous rating and no sacrifice in overload capacity.

**LINE MATERIAL**
Transformers

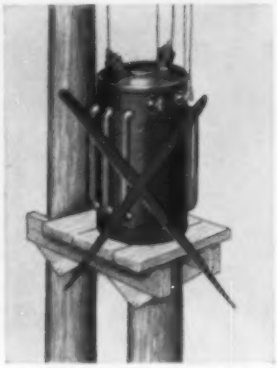


CONTINUED →

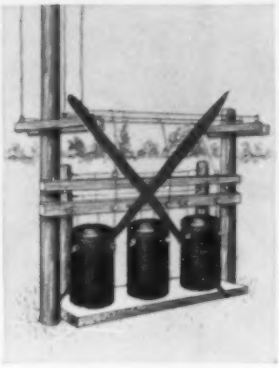
# L-M's Light-Weight Obround Transformer Eliminates Costly Construction Measures



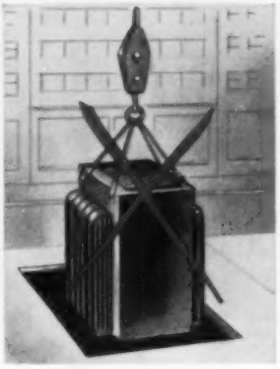
You can now hang more capacity on a single-pole, three-phase structure, serve more load, and reduce or eliminate the need for a two-pole structure.



L-M's new light-weight 167 kva transformer can be pole-mounted, eliminating the need for a stub or platform and making further use of existing facilities.



Mounting three new 167 kva obround transformers on a 2-pole structure provides full 500 kva, eliminates costly alternative measures such as ground-type overhead structures.



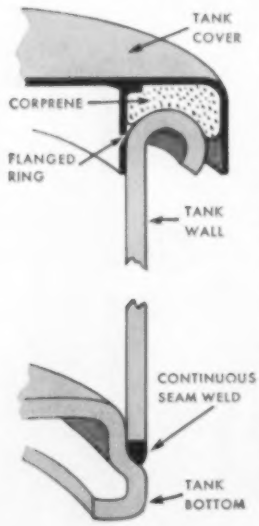
Obround transformers increase the potential capacity of all your transformer structures, reducing the need for expensive underground systems and subway or vault installations.

L-M's light, obround tank design transformers are available in each distribution voltage class, single-phase ratings 5 kva through 167 kva.

**Get Details On Lighter-Weight, Obround Transformers**

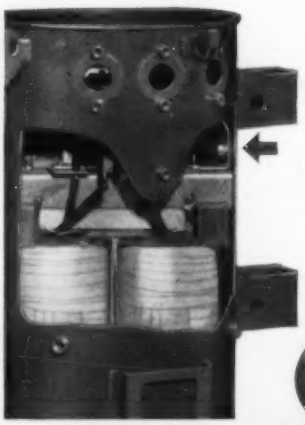
Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write Mr. Coyle at Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

## and of course, L-M means Low Maintenance




**Tanks**—Sealed for the future, not just for today. Resilient Corprene® cover gasket, gas-proof, oil-resistant and ageless, has improved and unexcelled effectiveness in a new removable ring for positive position and retention. Maximum ease of clamping consistent with assured maintenance of seal without attention through the Round-Wound's long service life.

**Tank Base**—L-M's new tank base design adds strength and rigidity to transformer tank unit. The base is bonded to tank wall by a continuous submerged arc weld for effective seal and neat appearance.



**Internal Assembly**—Vibration-proofed against accidental loosening, the core and coil assembly is securely clamped through the use of positive, self-locking nuts and bolts. Similarly, the complete assembly is locked to the tank.

**LINE MATERIAL**

Transformers

# ONLY *Collins* MICROWAVE has MECHANICAL FILTERS

Collins mechanically-filtered multiplex equipment provides simultaneous transmission and reception for voice circuits. Each of these voice channels may contain up to 16 teletype, telemetering and supervisory control channels. The system employs proven bi-lateral, single sideband suppressed carrier transmission. Intelligence is transmitted only when a circuit is in use, thereby permitting statistical loading of the system to achieve a maximum signal-to-noise ratio on each channel. This method of multiplexing is simplified and made economical by the use of the Collins Mechanical Filter. The steep skirt attenuation of this filter permits use of upper and lower sidebands with suppressed carrier to be employed for transmission of two separate channels.

Collins microwave engineering staff is ready to assist you in planning and installing your microwave system.

**Visit Collins Booth at the New York IRE Show March 21-24**

Write Microwave Dept. B for descriptive literature.

## SIX MORE REASONS FOR COLLINS

- Tubeless power supplies using magnetic amplifiers for regulation
- Built-in test facilities to expedite routine maintenance
- Only five tube types, including reflex klystron
- Operates in 6700 mc band using high gain, highly directive antennas and reflectors. No tower-mounted transmission lines
- Designed for reliable unattended operation, optional automatic switchover to standby equipment with fault alarm
- Facilities may be expanded at minimum cost

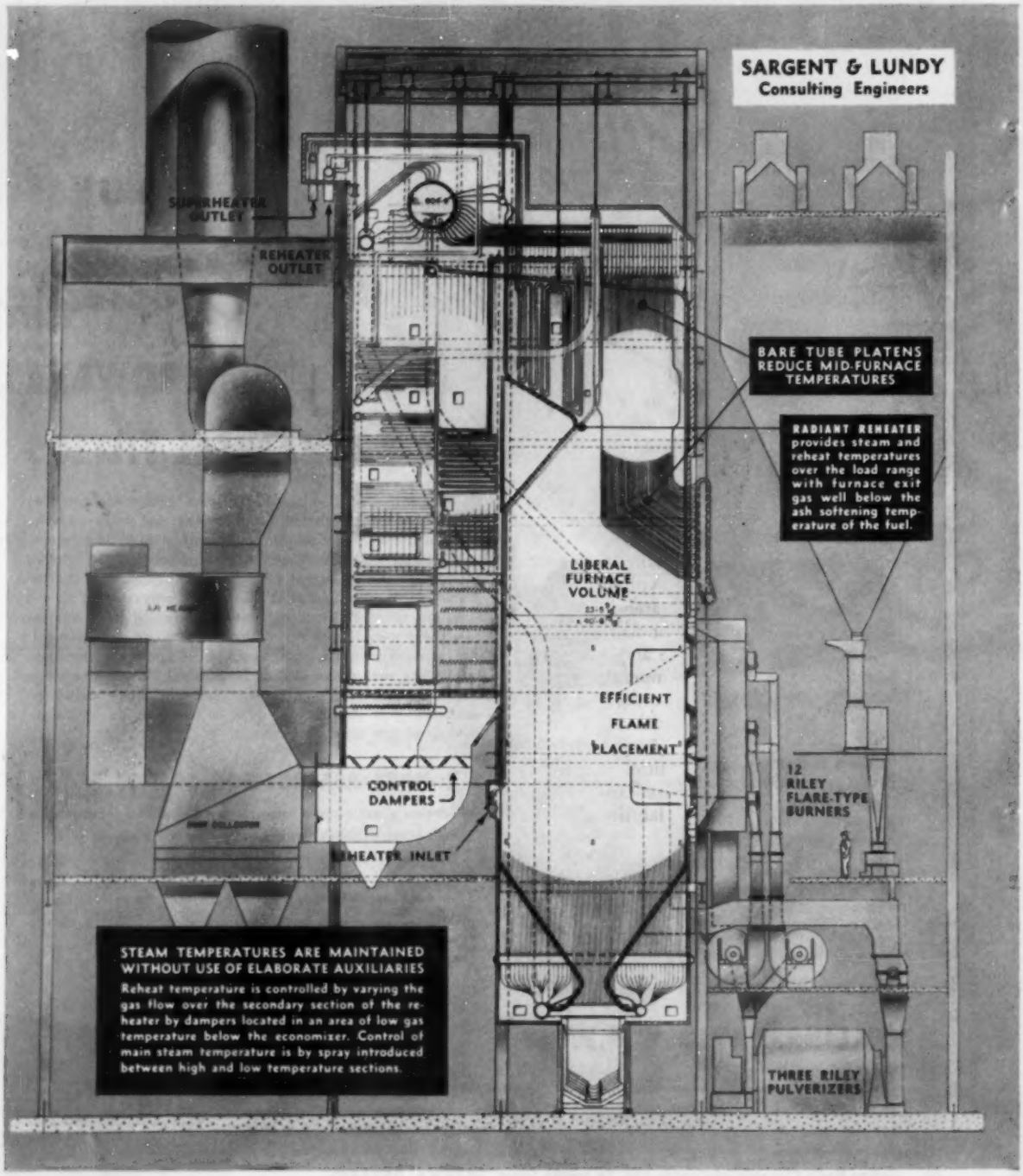
**COLLINS RADIO COMPANY**
Cedar Rapids, Iowa

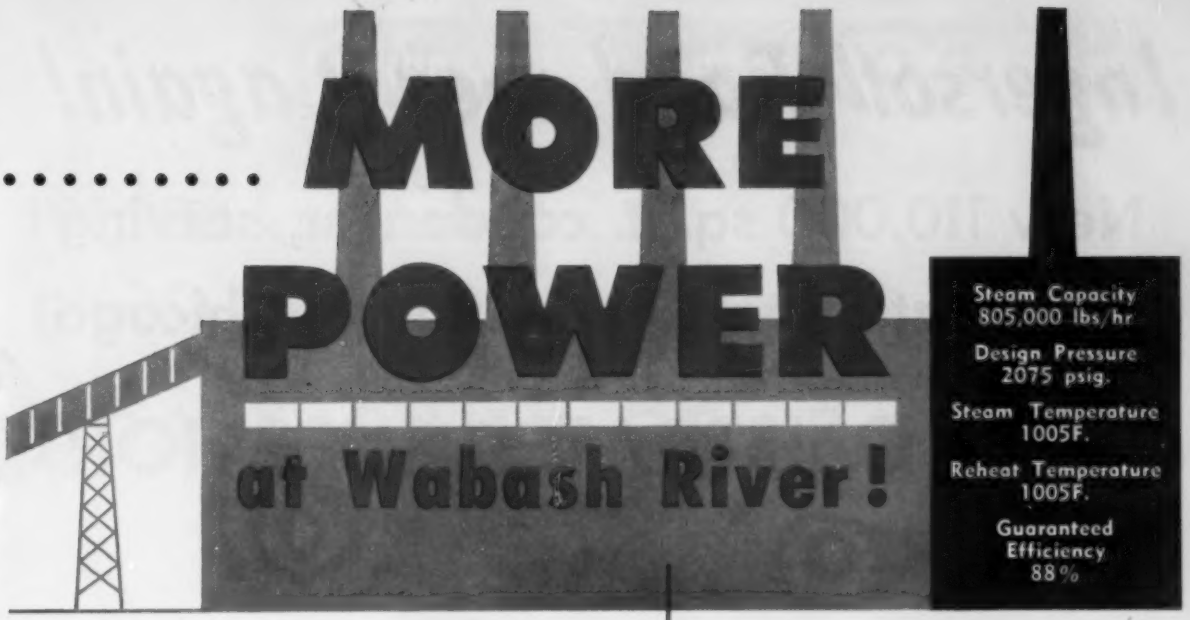
261 Madison Ave., NEW YORK 16
1930 Hi-Line Dr., DALLAS 2
2700 W. Olive Ave., BURBANK
Collins Radio Company of Canada Ltd., 74 Sparks Street, OTTAWA, ONTARIO

COLLINS

# Public Service Company of Indiana, Inc.

## selects this RILEY reheat unit for . . . .


SARGENT & LUNDY
Consulting Engineers
SUPERHEATER OUTLET
REHEATER OUTLET
BARE TUBE PLATENS REDUCE MID-FURNACE TEMPERATURES
RADIANT REHEATER provides steam and reheat temperatures over the load range with furnace exit gas well below the ash softening temperature of the fuel.
LIBERAL FURNACE VOLUME
EFFICIENT FLAME PLACEMENT
CONTROL DAMPERS
REHEATER INLET
12 RILEY FLARE-TYPE BURNERS
THREE RILEY PULVERIZERS
STEAM TEMPERATURES ARE MAINTAINED WITHOUT USE OF ELABORATE AUXILIARIES
Reheat temperature is controlled by varying the gas flow over the secondary section of the reheater by dampers located in an area of low gas temperature below the economizer. Control of main steam temperature is by spray introduced between high and low temperature sections.




Typical of the trend to more efficient and economical steam generating units is the Riley reheat unit recently purchased by Public Service Company of Indiana, Inc. This unit, the fifth and largest to be installed at the new Wabash River station is designed *specifically* to burn *successfully* poor grades of Indiana coal.

Design features that make this performance possible are: liberal furnace volume, adequate furnace cooling, bare tube platens to reduce mid-furnace temperatures, efficient flame placement, the use of radiant reheat surface and a combination of damper and spray steam temperature control.

The acceptance of Riley units by Public Service Company of Indiana, Inc. (this is its eighth Riley unit) . . . and by a steadily increasing number of other leading public utilities is due to design characteristics such as featured by this unit, high yearly net efficiency, dependability and continuity of operation.

For specific explanations and detailed descriptions of complete Riley steam generating unit designs write or call your nearest Riley Sales Engineer.

***Public Service Co. of Indiana, Inc. is one of many important public utilities that in recent years have ordered Riley Reheat Units . . .***

**Utah Power & Light Company**
Gadsby Station
1-575,000 lbs/hr; 1700 psig; 1000/1000F.

**Louisiana Power & Light Company**
Nine Mile Point Station
1-1,000,000 lbs/hr; 1725 psig; 1005/1005F.

**City of Los Angeles, Dept. of Water & Power, Valley Steam Plant**
2-1,200,000 lbs/hr; 2075 psig; 1000/1000F.

**Houston Lighting & Power Company**
Deepwater Station and Sam Barton Steam-Electric Station each
1-1,200,000 lbs/hr; 2125 psig; 1005/1005F.

**Texas Electric Service Co.**
Fort Worth
1-1,250,000 lbs/hr; 2125 psig; 1005/1005F.

**Central Louisiana Electric Company, Inc.**
Teche Station
1-350,000 lbs/hr; 1050 psig; 1005/1005F.

**Florida Power Corp.**
Suwannee River Plant
1-600,000 lbs/hr; 1550 psig, 1000F/1000F.

**Dairyland Power Cooperative**
Alma, Wisconsin
1-390,000 lbs/hr; 1650 psig; 1005/1005F.

*A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.*

**RILEY**
*Stoker Corporation*
WORCESTER, MASSACHUSETTS

Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

***Complete Steam Generating Units and Fuel Burning Equipment for Public Utility and Industrial Power and Heating Plants***

# *Ingersoll-Rand does it again!*

## New 110,000 sq. ft. condenser, serving at State Line Station of Chicago

## DEMONSTRATES SUPERIOR

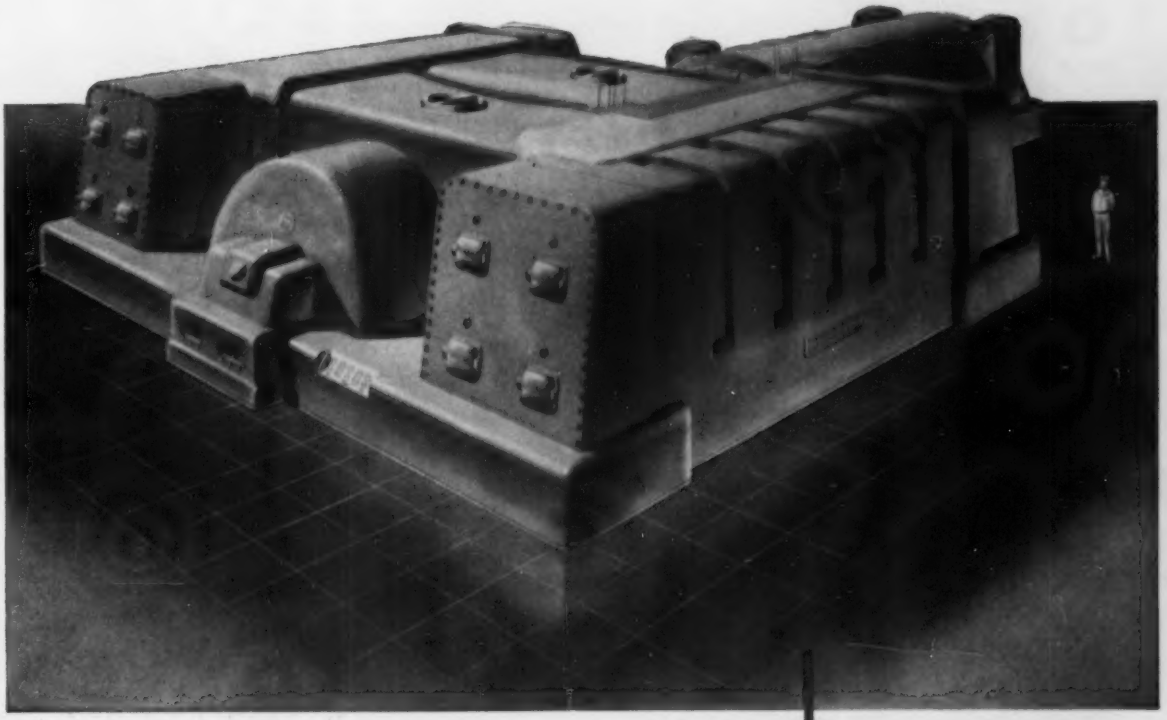
The new condenser at Chicago's State Line Station offers another example of the adaptability of Ingersoll-Rand condenser design. It consists of two shells, installed parallel to the shaft of the low-pressure element of the cross-compound steam turbine generator. Each shell has 55,000 sq. ft. condensing surface and forms a unified construction with the turbine's side exhaust which it serves. This forward-looking design for Unit No. 3 eliminates the problems which would have been encountered if vertical condensers had been used in this design.

Ingersoll-Rand surface condensers have long set the pace in central station practice. Back in 1920, the basic principle of the I-R surface condenser was introduced as an entirely new concept in design. Ever since, an extensive program of research has been carried on to construct condensers that give top performance in minimum space—under any specified operating conditions. This design for the State Line Station is typical of Ingersoll-Rand's leadership in surface condenser progress.

Ingersoll-Rand horizontal condensate pumps will be used—and three I-R 10-stage Class CHTA "double-case" high-pressure boiler feed pumps will also serve Unit No. 3 at State Line. Ask to have an I-R specialist study your power plant equipment needs—and submit recommendations to meet your particular requirements.

**Wholly owned subsidiary of Commonwealth Edison Company*

# 191,000 kw Unit No. 3
# District Electric Generating Corporation*
# ADAPTABILITY OF I-R DESIGN



Ingersoll-Rand 110,000 sq. ft. twin-shell surface condenser, to be installed in State Line Station, Chicago District Electric Generating Corporation. Sargent & Lundy, Consulting Engineers.

**Ingersoll-Rand**

11 Broadway, New York 4, N. Y.

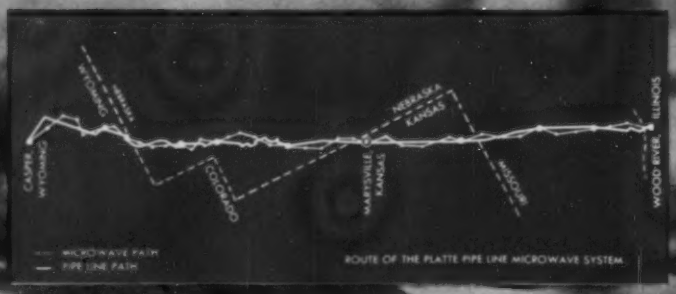
4-126

VACUUM EQUIPMENT • ROCK DRILLS • TURBO-BLOWERS

# PHILCO MICROWAVE..

## HOW PHILCO MICROWAVE IS HELPING PLATTE:

- **Operating efficiency increased.**
- **Operating costs reduced.**
- **Provides these communications facilities:**
  **4 separate telephone circuits for business, dispatch, confidential and stockholder use.**
- **Provides these control functions from Kansas City Control Center:**
  **Reading of tank levels, pressure, flow of oil.**
  **Opening and closing of line valves.**
  **Start and stop main line pumps.**
  **Station shutdown.**




Platte microwave repeater station at Midway, Wyoming.

PHILCO *Famous for* QUALITY *the World Over*

# PHILCO CORPORATION

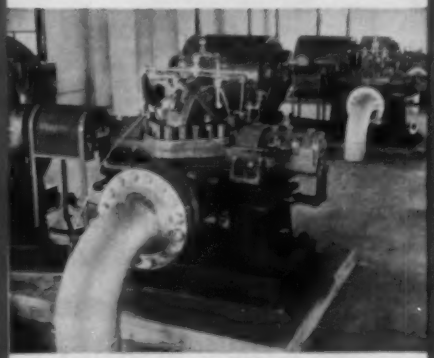
# ..boosts Platte Pipe Line efficiency!

The Philco microwave system of the Platte Pipe Line Company—the largest and most comprehensive installation of its kind—demonstrates the economic advantages of microwave better than any other pipe line microwave system in the nation. Here is what A. R. Heidebrecht, Chief Engineer of Platte, has to say about the system: "Our decision to use microwave was greatly influenced by the number of pipe line control functions which could be accomplished remotely and automatically. Operation to date has proved very successful; in fact, during the short time this system has been in use, the efficiency of our pipe line operation has been substantially increased."

Perhaps microwave can lower operating costs and boost the efficiency of your plant. Philco maintains a staff of experienced field and system engineers who can help plan and install your microwave system. Get information on the many leading Philco microwave installations in use today. Write to Philco, Dept. EW.

Platte Pipe Line control center at Kansas City.

Microwave operates valves along the pipe line.



Pipe line pump station operated by microwave.

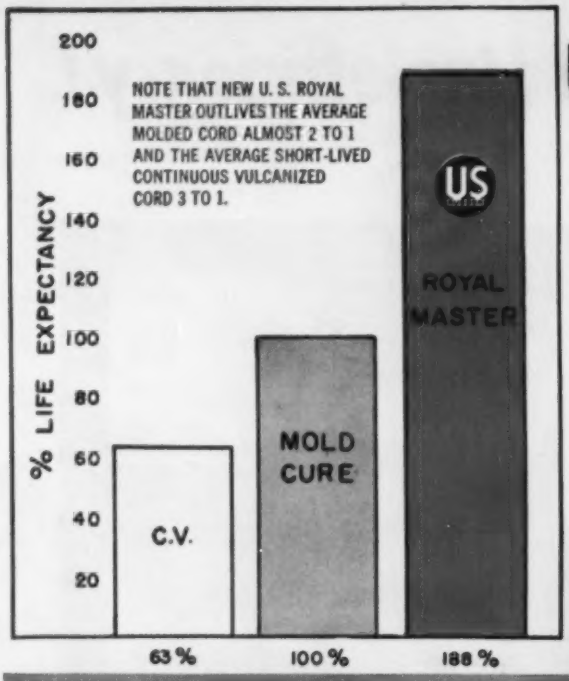
**PHILCO—WORLD'S LEADING MANUFACTURER OF MICROWAVE**

GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44, PENNSYLVANIA

In Canada, Philco Corporation of Canada Limited, Don Mills, Ontario

# Now...88% longer

# U.S. ROYAL




Chart—summarizing individual service factors weighted by their contribution to overall service life—shows new U. S. Royal Master Cord gives 88% longer life than the average of competitive molded cords.

LOOK FOR THE NAME—

**U.S. ROYAL MASTER**

## Superior on every count!*

- 33.3% greater heat resistance
- 55.7% greater impact strength
- 53.8% greater abrasion resistance
- 30.6% greater resistance to cutting
- 110.3% greater resistance to tearing
- 21.2% greater tension or breaking strength
- 23.3% greater oil resistance
- 128.8% greater flexibility

*to the average of molded cords of other makes

US RUBBER

**UNITED STATES**

**ELECTRICAL WIRE AND CABLE DEPARTMENT**

# *cord life—with NEW* MASTER portable cord!

## Far outlasts *any* other cord made!

**Service to cost ratings show new U. S. Royal Master Cord actually gives $1.88 in value for every cord dollar when compared to the average competitive molded cord!**

Two years ago, "U. S." engineers began a *complete reexamination* of portable cord construction, service life, and the causes of cord failure.

Over 10,000 tests were made. More than a thousand cords of all leading makes, including our own famous U. S. Royal Cord, were analyzed, tested, and compared.

Every life factor was considered and carefully evaluated, alone and in its relation to overall cord performance and service life.

Backed by 64 years of experience in the manufacture of electrical wire and cable, U. S. Rubber engineers then translated their findings into an entirely new portable cord, designed to surpass any other previously made.

Extensive tests, both in the laboratory and in outside plant installations have proved this new portable cord startlingly superior in every respect!

New U. S. Royal Master is unquestionably the finest cord you can buy!

From every standpoint, new U. S. Royal Master is a finer, more durable cord — actually gives 88% longer life than the average of other molded cords — far longer than *any* other cord — surpassing even a *hypothetical* cord incorporating the best features of all those tested!

Far greater value, too! In spite of almost doubled service life, this great new cord is in the same price category as other molded cords—giving you $1.88 in cord value for every cord $1.00!

Prove to yourself the outstanding superiority of new U. S. Royal Master Portable Cord—in both service life *and* economy! Write address below for FREE descriptive booklet illustrating the superiority of the U. S. Royal Master Cord. And get in touch with your "U. S." distributor today!

Approved by Underwriters' Laboratories, Inc.

**RUBBER COMPANY**

**ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

## Allis-Chalmers Multi-Steam Path

# Top Efficiency . . . Simplified Plant Layout

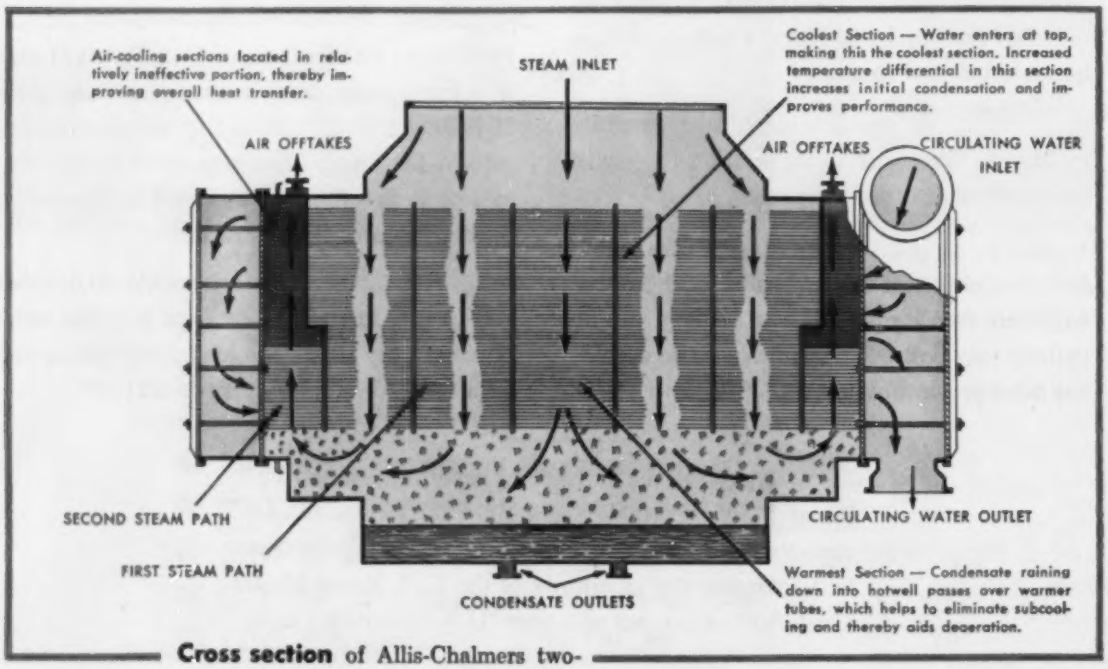
HERE'S WHY: Allis-Chalmers multi-steam path condenser design makes all tubes completely effective by directing the steam to even the remote sections of the condenser, thereby producing a high vacuum.

Steam, penetrating all parts of the condenser, keeps condensate temperature high and drives off dissolved oxygen.

This combination of high vacuum, high condensate temperature and good deaeration means high operating efficiency.

Plant layout problems are simplified, too! Allis-Chalmers multi-steam path condensers can be built in round, oval or rectangular shape, in any type or size.

**GET INFORMATION:** 24-page bulletin 19B7987 tells the story about the unsurpassed design, unmatched manufacturing facilities and A-C experience from building over 20 million square feet of condensers. Call your nearby A-C office for a copy, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

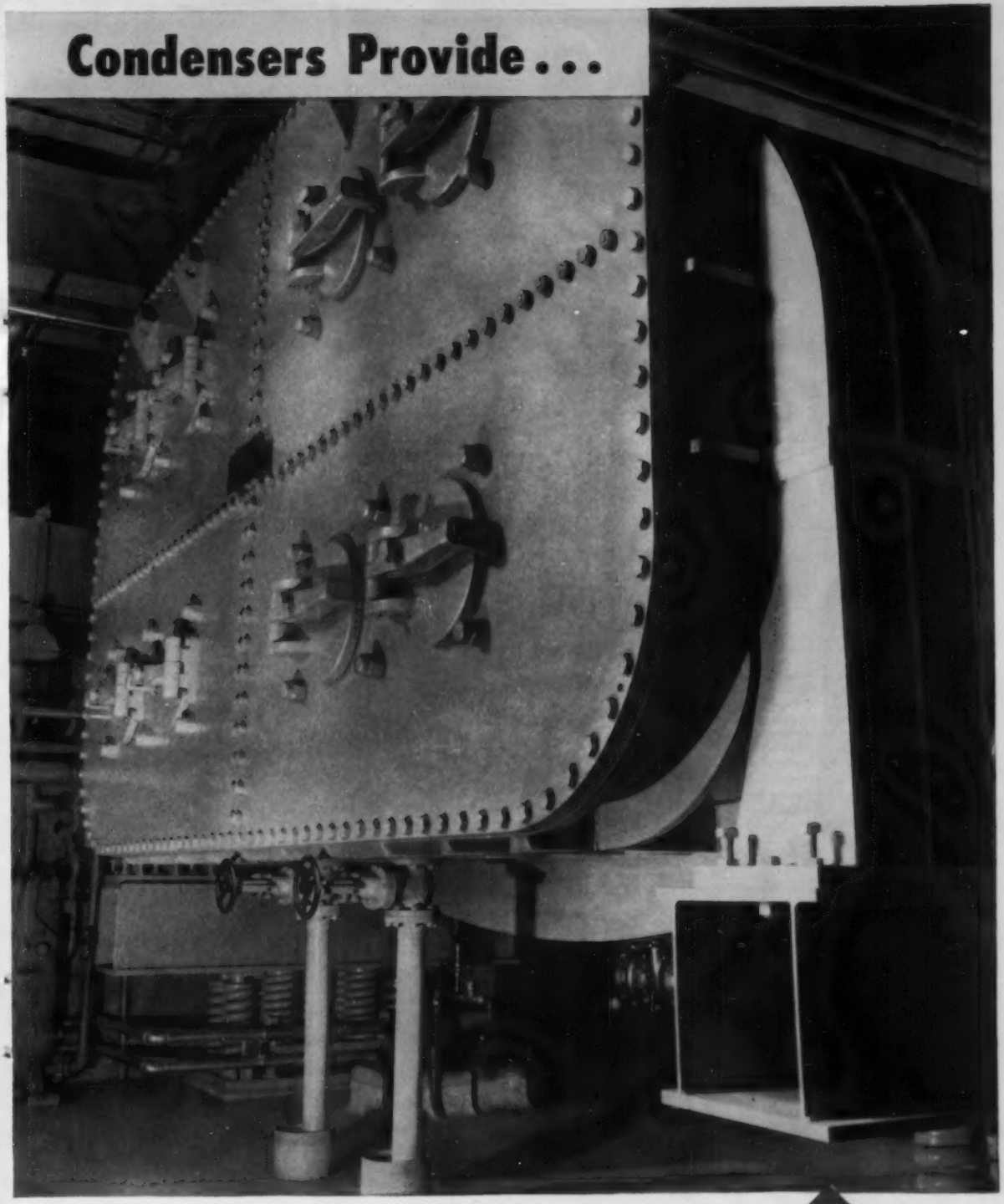

Air-cooling sections located in relatively ineffective portion, thereby improving overall heat transfer.
STEAM INLET
Coolest Section — Water enters at top, making this the coolest section. Increased temperature differential in this section increases initial condensation and improves performance.
AIR OFFTAKES
AIR OFFTAKES
CIRCULATING WATER INLET
SECOND STEAM PATH
FIRST STEAM PATH
CONDENSATE OUTLETS
CIRCULATING WATER OUTLET
Warmest Section — Condensate raining down into hotwell passes over warmer tubes, which helps to eliminate subcooling and thereby aids deaeration.

**Cross section** of Allis-Chalmers two-pass multi-steam path condenser illustrates design features that make these condensers outstanding in the industry.

A-4398

ALLIS-

## Condensers Provide...



# CHALMERS

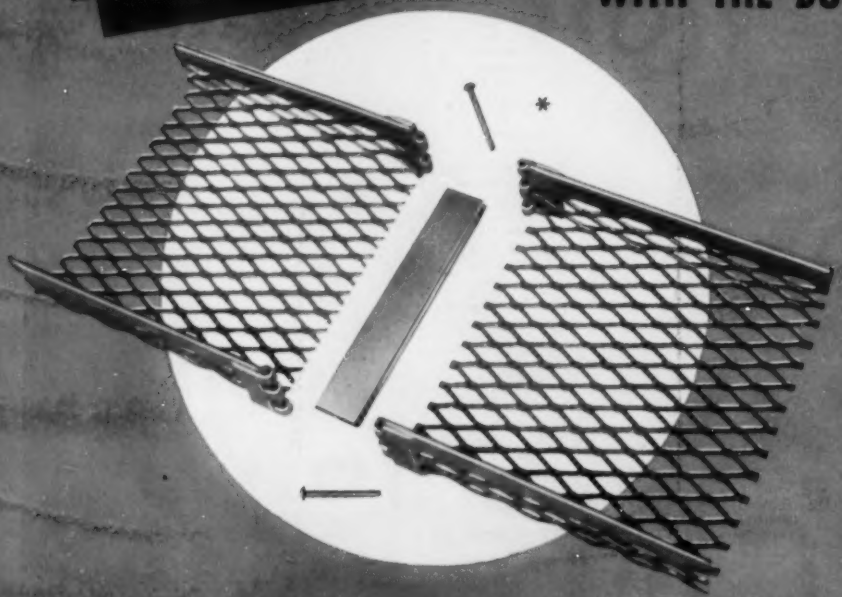
A-C ALLIS-CHALMERS

# Announcing

another Cope FIRST

the new COPE CABLE TROUGH

## WITH THE BUILT-IN COUPLER



up to **80%** SAVINGS in erection time

The new Cope coupler is an integral part of all units. A metal "X" shaped piece is also supplied for each joint to fit between the ends of the mesh and thus eliminate sharp edges. Cope Cable Trough Systems are available in widths of 6", 9", 12", 18" and 24" and in straight lengths of 8', 10' and 12'. A wide range of fittings for each width permits the system to be rapidly assembled on the job site to conform to any plant layout.

Should field cutting of the trough be required, special bolt-on couplers are available which will join the cut-off end of the trough to the regular pin-type coupler.

Cope

T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.

*Patent Pending

ANOTHER EXAMPLE OF Cope LEADERSHIP...

## REPRESENTATIVES

AMARILLO, TEXAS
Williamson Sales Co., Box 1324

ATLANTA, GEORGIA
The Gearhart Co., P. O. Box 85, Northside Station

BALTIMORE, MARYLAND
J. D. Amelia, 208 W. Chesapeake Ave., P. O. Box 6759, Towson, Baltimore, Md.

BEAUMONT, TEXAS
Williamson Sales Co., P. O. Box 3164

BIRMINGHAM, ALABAMA
The Gearhart Company, 1727 Sixth Avenue, North

BOSTON, MASSACHUSETTS
J. J. Costello Co., 131 Clarendon Street

BUFFALO, NEW YORK
Vincent J. Brown Co., 564 Ellicott Square

BUTTE, MONTANA
Fred W. Carlson, 604 Utah Avenue

CHARLOTTE, NORTH CAROLINA
Glenn & Larson, 123 Brevard Court

CHICAGO, ILLINOIS
Hooper-Green Co., 407 S. Dearborn St.

CLEVELAND, OHIO
E. F. Burke Agency, 1900 Euclid Avenue

CORPUS CHRISTI, TEXAS
Williamson Sales Co., 922 Wilshire St.

DALLAS, TEXAS
Williamson Sales Co., Slocum at Cole St.

DEARBORN, MICHIGAN
George R. Horne Company, 22187 Michigan Avenue

DENVER, COLORADO
Hamilton Associates, 1236 Elati Street

DES MOINES, IOWA
Geo. W. Swallow, Chas. L. Ward Co., 5707 Waterbury Circle

HOUSTON, TEXAS
Williamson Sales Company, 5541 Armour Drive

HUNTINGTON, WEST VIRGINIA
Muller, Harper & Assocs., Inc. 407 Twelfth Street

INDIANAPOLIS, INDIANA
Hooper-Green Co., 6216 Carrollton Ave.

JACKSON, MISSISSIPPI
Williamson Sales Company P.O. Box 3223, West Jackson Station

KANSAS CITY, MISSOURI
Chas. L. Ward Co., 3122 Roanoke Road

LOUISVILLE, KENTUCKY
Hooper-Green Company, 319 Marion E. Taylor Bldg.

MIAMI, FLORIDA
The Gearhart Co., 416 Langford Bldg.

MINNEAPOLIS, MINNESOTA
The Klass Company, 814 So. Ninth St.

NEW HAVEN, CONNECTICUT
J. J. Costello Co., P. O. Box 88

NEW ORLEANS, LOUISIANA
Williamson Sales Company 210 Delta Bldg.

NEW YORK, NEW YORK
David M. Miller Co., Inc., 31 Nassau St.

OKLAHOMA CITY, OKLAHOMA
Harold E. Bates, Chas. L. Ward Co., 3125 N.W. Grand Blvd.

PHILADELPHIA, PENNSYLVANIA
The Bradley Co., 3341 Arch Street

PINE BLUFF, ARKANSAS
Williamson Sales Company, P.O. Box 3

PITTSBURGH, PENNSYLVANIA
Muller, Harper & Assocs., Inc., First National Bank Bldg.

PORTLAND, OREGON
Fred W. Carlson, 935 Northwest 12th St.

ST. LOUIS, MISSOURI
Edwin S. Waterman, 494 Arcade Bldg., 812 Olive Street

SAN ANTONIO, TEXAS
Williamson Sales Company, Box 1324

SAN FRANCISCO, CALIFORNIA
Geo. E. Hann Co., 420 Market Street

SAN GABRIEL, CALIFORNIA
H. J. Randolph Co., 736 Santa Anita St.

SEATTLE, WASHINGTON
Fred W. Carlson, 2307 Fifth Avenue

SHREVEPORT, LOUISIANA
Williamson Sales Company P.O. Box 1223

SYRACUSE, NEW YORK
Vincent J. Brown Co., 218 Harrison St.

CANADA

CALGARY, ALBERTA
Bunston, Ltd., 310 9th Avenue, West

DORVAL STATION, P. O. (Montreal)
Marshall Equipment Co., Inc., P. O. Box 28

VANCOUVER, B. C.
Bunston, Ltd., 2532 Yew Street

FOREIGN

MANILA, PHILIPPINE ISLANDS
Communications Electrical Equipment & Supply Co., Inc., 517 Dasmarinas, P. O. Box 58

SANTURCE, PUERTO RICO
Victor M. Garcia, 1357 Ponce de Leon Ave.

**The New Cope Cable Trough has a built-in coupler . . . this is typical of the constant efforts of T. J. Cope, Inc. to bring you a stronger and more economical product.**

**In line with these efforts, Cope pioneered and developed the acceptance of Cope Cable Trough through original design, engineering service and high quality manufacturing standards.**

**Now Cope has anticipated its many customers' needs for a product which will save up to 80% in erection time and give still greater strength.**

**Every straight length and fitting in the versatile Cope Cable Trough system now has a built-in coupler—no more nuts, bolts and washers!**

**The Cope Representative in your territory will be glad to explain the new coupler and show you samples so that you can have the advantage of this latest Cope development in your next new construction program or plant modernization project.**

Write today for the new Cope Bulletin which illustrates and describes the New Cope Cable Trough with the built-in coupler. Ask for Bulletin EW-2

# How do *You* design contacts?

CONTACTS can be *too good* for their job . . . in which case they add useless extra expense. Similarly, they can *fall short* of needed performance . . . and lead to costly repairs and loss of dependability. Unless you are engineering contacts exactly for your product's requirements, you may be missing opportunities to make substantial improvements in the performance and cost of your product.

To design contacts accurately for their intended use, *all* electrical, mechanical and environmental factors of the application require attention. How much current is to be broken, at what voltage, in what kind of circuit? How many make-and-break cycles . . . and how often? What contact pressures? What atmospheric conditions?

The answers to these questions . . . and many more . . . form the basis of Mallory's engineering of your particular contacts.

***How Mallory Contact Engineering Helps You***

Mallory engineers will help you select the most effective contact material from the extensive line of special Mallory alloys. If your application involves standard service conditions, a standard Mallory design can often be recommended . . . at substantial savings to you. For special requirements, Mallory engineers are well qualified to assist in design of special contacts . . . drawing on the experience gained in many years of contact research and development.

The result is a contact engineered exactly to your needs . . . capable of giving the performance you want, at a cost that fits the intended use. You can gain further savings, too, by having Mallory fabricate complete contact assemblies to your specifications in our efficient manufacturing plant.

Ask a Mallory engineer to talk over your own contact problems. For a consultation, or for a copy of our Contact Catalog, write or call Mallory today.

***Expect more...***
***Get more from***
**MALLORY**

*In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario.*

**Serving Industry with These Products:**

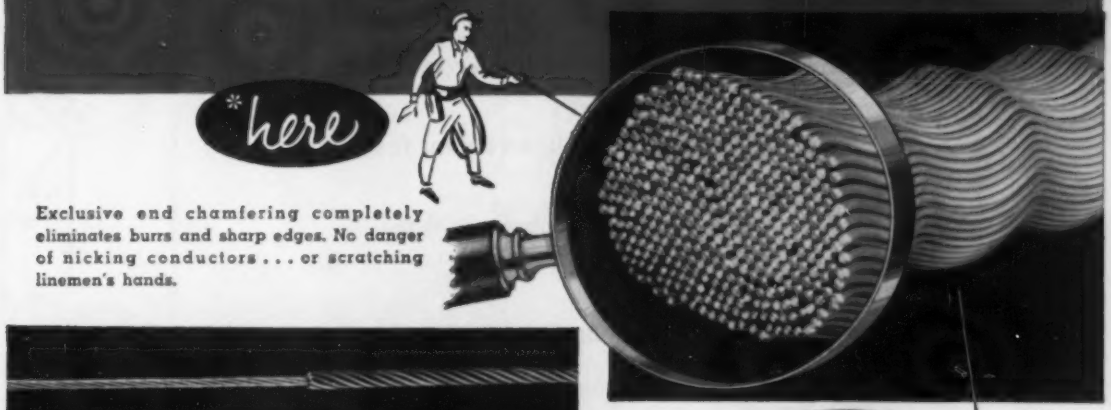
**Electromechanical**—Resistors • Switches • Television Tuners • Vibrators
**Electrochemical**—Capacitors • Rectifiers • Mercury Batteries
**Metallurgical**—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc. INDIANAPOLIS 6, INDIANA

every good turn deserves another . . .

fine **FANNER** superformed **ARMOR RODS**

**EXTRA QUALITY* where QUALITY COUNTS**



*here

Exclusive end chamfering completely eliminates burrs and sharp edges. No danger of nicking conductors . . . or scratching linemen's hands.

*here

Exclusive forming method provides precisely formed rod contours, held to extremely close tolerances, and free of surface blemishes.

*here

Improved rod designs, tailored for easy application and made of high grade spring-type alloys, result in a tight grip and the elimination of "crowding."

*here

Wide range of sizes available for shipment from stock in improved packages. Only Fanner Superformed Armor Rods are protected along their entire length as well as ends.

With all these extra features (and more too), fine Fanner Superformed Armor Rods cost you no more than ordinary rods. Like all fine Fanner products, Fanner Superformed Armor Rods are outstanding in quality . . . based on sound engineering experience and over 50 years of manufacturing know-how. Write today to be placed on our mailing list.

Fine FANNER Superformed

**THE FANNER MANUFACTURING CO.**

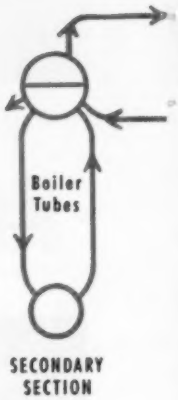
BROOKSIDE PARK • CLEVELAND 9, OHIO

*Established 1896*

# dual circulation

## provide high-purity steam

- with high feedwater makeup
- with high silica content feedwater
- at pressures above 600 psi




*Cost-saving advantages of the exclusive FW dual circulation system now thoroughly proved by over 6 years of successful operation*

THE DUAL CIRCULATION STEAM GENERATOR was developed by Foster Wheeler to provide a practical means of reducing carryover of silica and dissolved solids from 100% makeup feedwater. At pressures over 600 psi, this carryover often causes costly turbine outages. With today's trend to higher pressures and temperatures, and larger sized units, carryover problems are sharply accentuated and the dual circulation principle offers still greater advantages.

As shown in the diagram above, the Dual Circulation Steam Generator utilizes two separate heat-absorbing sections, each with its own independent natural circulating system. The primary section, comprising principally the furnace walls, is blown down at a high rate, providing the feed to the secondary section. Steam from the secondary system is returned to the primary, where it is condensed in whole or in part by the incoming feedwater. Hence, virtually all of the steam delivered to the turbine is generated in the low-concentration primary section, thus sharply reducing silica carryover and total dissolved solids.

Predicted data on the first FW Dual Circulation Steam Generators have been fully confirmed by more than six years of operation with five 300,000 lb/hr, 1350 psi units having 100% makeup. Average silica carryover is only .004 ppm, compared to .08 ppm expected for a boiler of conventional circulation. Carryover of total dissolved solids is .007 ppm, compared to .56 ppm expected for a conventional unit.

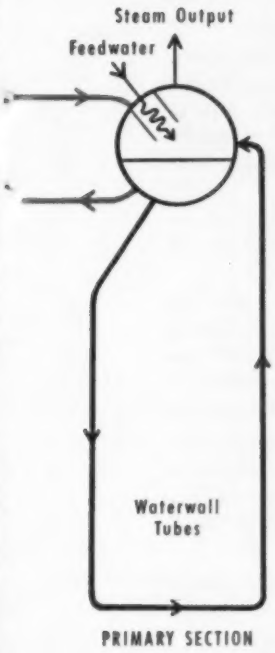
Additional benefits include reduction of tube damage due to low concentration in primary section; reduced final blowdown with substantial saving in blowdown heat recovery equipment; and reduced cost of the makeup treating plant.

Wherever *high purity steam* is required, in central station or industrial service, FW Dual Circulation Steam Generators offer important savings in operating and maintenance cost.

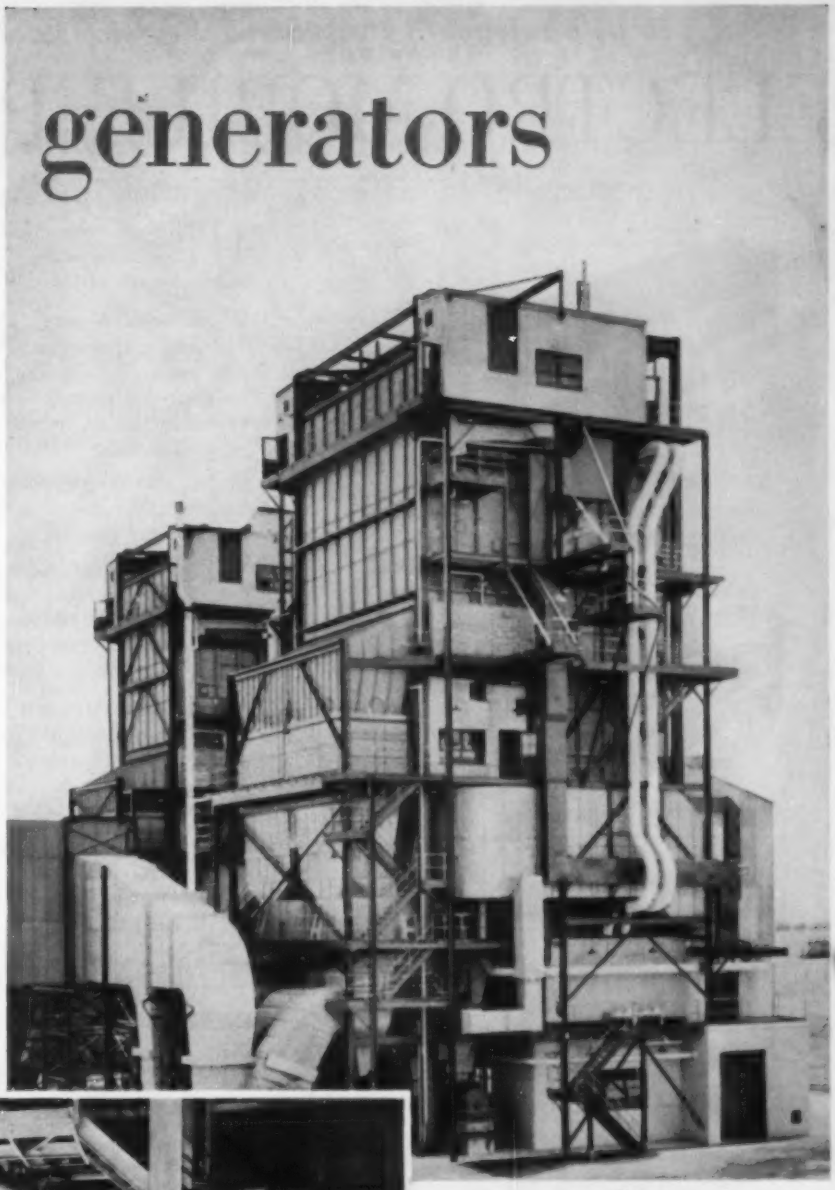
**FOR COMPLETE INFORMATION** on FW Dual Circulation Steam Generators, send for your free copy of 16-page Bulletin B-50-11. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

# FOSTER WHEELER

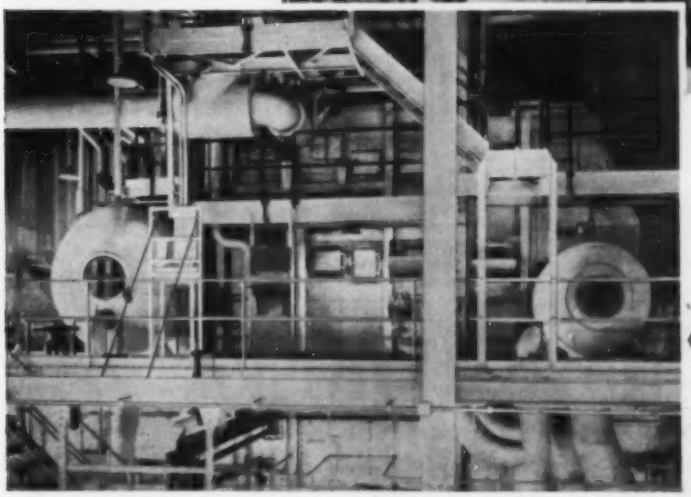
# steam generators




Simplified flow diagram of typical 3-drum Dual Circulation unit. Blowdown from primary feeds continuously into secondary section. Final blowdown is from secondary drum.



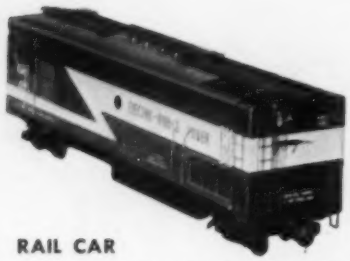
**KANSAS GAS AND ELECTRIC CO.** recently installed these two FW Dual Circulation units at the Murray Gill Steam Electric Station. One has a capacity of 425,000 lb/hr and the other, 625,000 lb/hr – both operating at 1350 psi, 955F. Consulting Engineers were Ebasco Services, Inc.



**A LARGE MID-WESTERN REFINER** has installed five FW Dual Circulation Steam Generators, each unit designed for 300,000 lb/hr at 1350 psi, 900F, with 100% feedwater makeup. Photo shows upper drums of one of the five 3-drum units. Consulting Engineers were Stone and Webster Engineering Corp.

*To help safeguard Electric Utility service standards—*

# ELECTRO-MOBILE POWER

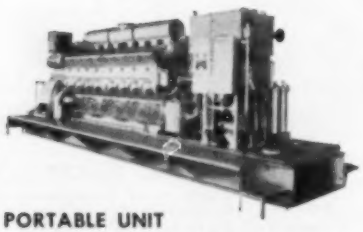


**RAIL CAR**

1000 and 750 kw. units for use on sidings or placed on piers for semi-permanent use.

**TRUCK TRAILER**

500 and 350 kw. units to move on highways to desired sites.



**PORTABLE UNIT**

1000, 750, 500 and 350 kw. capacities for permanent or semi-permanent installations.

HERE'S an economical new power supply for electric utilities to call on when demands get out of balance with supply.

It's General Motors' Electro-Mobile units. They can augment central station capacity for peak skimming—handle fringe area interim boosting—or provide an independent supply wherever the utility company faces a temporary demand.

Placed at strategic points by either rail or highway, they can be used in multiple to fill needs of any amount.

They are surprisingly low in cost, for they are mass-produced. Their dependability is assured by the latest and best in design and manufacturing methods based on long experience in similar lines. Service facilities are nationwide.

And the investment gets long-term protection, because Electro-Motive designs improvements so they may be incorporated in earlier models. Thus the equipment can always be brought abreast of new developments.

Electric utility companies wishing to insure adequate service under all circumstances are invited to write for full details.

***ELECTRO-MOBILE POWER FEATURES INCLUDE:***

- **Remote control starting and stopping**
- **From starting to full load within 45 seconds**
- **Automatic synchronization with line in phase, frequency and voltage**
- **Full protective equipment, including 3-phase surge capacitors, lightning arresters, over-current relays, field failure relay**
- **Complete self-operation can be provided**
- **Ability to meet higher capacity needs by unit multiplication**
- **Complete national parts and service availability**

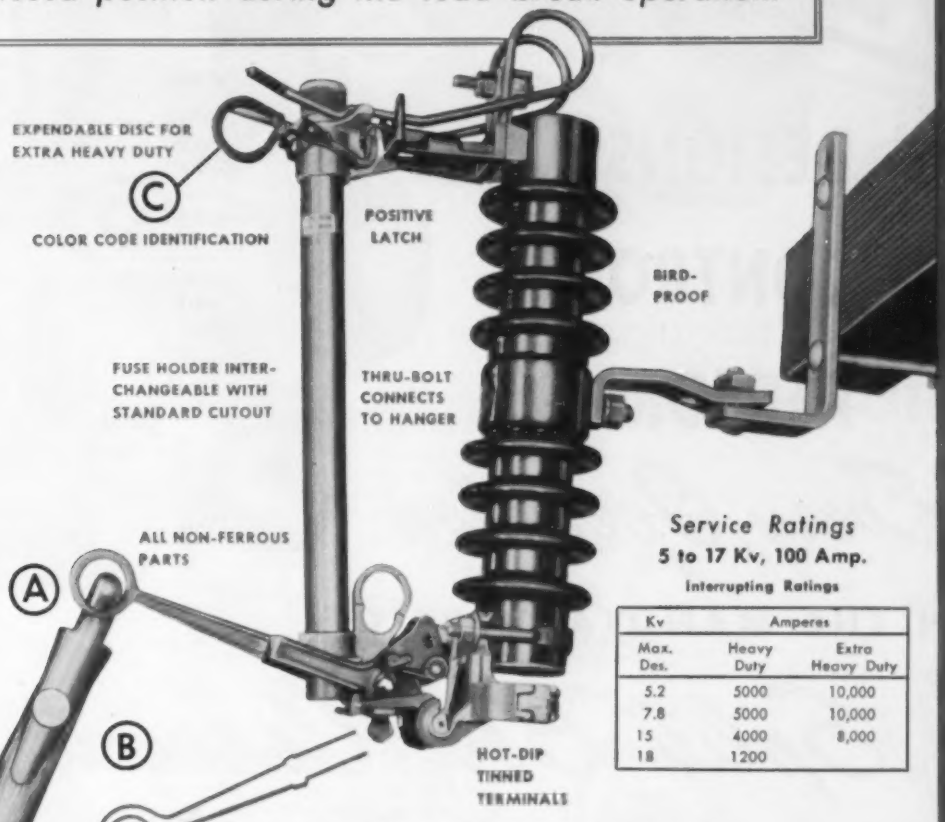
## ELECTRO-MOTIVE DIVISION

**GENERAL MOTORS • LA GRANGE, ILLINOIS**

*Sold and serviced directly through a manufacturer's organization. Electro-Motive Division offices located in: New York City, Chicago, Jacksonville, St. Louis and San Francisco.*

# NEW R&IE LOAD BREAK CUTOUT

*Features* **LOCK-IN safety feature** *to lock fuse holder in closed position during the load break operation.*




*Service Ratings*

**5 to 17 Kv, 100 Amp.**

**Interrupting Ratings**

| Kv | Amperes | |
|---|---|---|
| Max. Des. | Heavy Duty | Extra Heavy Duty |
| 5.2 | 5000 | 10,000 |
| 7.8 | 5000 | 10,000 |
| 15 | 4000 | 8,000 |
| 18 | 1200 | |

**OPERATION** - *made easier with large operating eyes.*

- The Load Break Cutout is operated by pulling on the opening eye "A" which is large and easily accessible. Pull fuse hook to position "B" and fuse link breaks, confining the arc to inside of the tube. During this operation the fuse holder is locked in closed position with a positive latch at the top contact, and a toggle latch at the hinge end. The secured end of the fuse link leader cannot slip out.
- After load break operation, push fuse hook back to position "A". This allows the fuse holder to automatically unlatch, drop down and swing open. To re-fuse, the fuse holder can be removed and replaced with a fuse hook.
- The fuse holder may also be easily removed by pulling on opening eye "C", releasing top latch, allowing fuse holder to swing open—without disturbing the Load Break mechanism.
- Simplicity of design and ease of operation offers distinct savings in installation and maintenance costs. Conforms to latest NEMA Standards.

*For demonstration* • *contact the nearest I-T-E office, or write direct to:*

**R&IE EQUIPMENT DIVISION**

I-T-E CIRCUIT BREAKER CO.

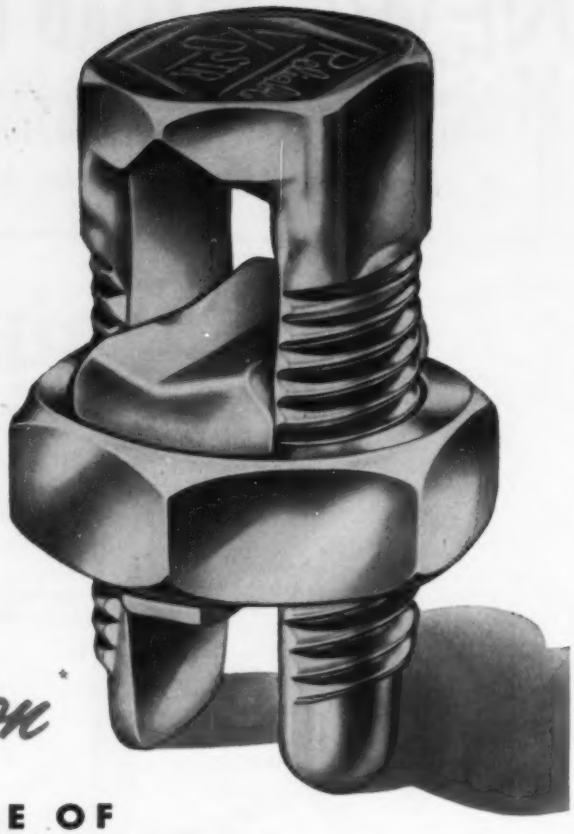
GREENSBURG, PA.

STRUCTURES • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION

Reliable

# DESIGNS
# CONTROLS
# PERFORMS
## *Every Operation*



**IN THE MANUFACTURE OF**

## *Split Bolt Connectors*

Forging tools and dies used in making Reliable Split Bolt Connectors are designed, made and maintained by long-experienced Reliable toolmakers.

Critical dimensions are held to close tolerances providing close thread engagement which assures constant pressure on conductors. Continuous inspection with precision tools guarantees that these close tolerances and consequent efficient performance are maintained at all times.

By making and inspecting all threaded parts and contacts in the same plant, Reliable provides Split Bolt Connectors that do a superior job under all conditions.

*Reliable Split Bolt Connectors test for pressure, torque and strength well in excess of standards. Reliable cold forged connectors are listed under Re-examination Service, Underwriters' Laboratories.*

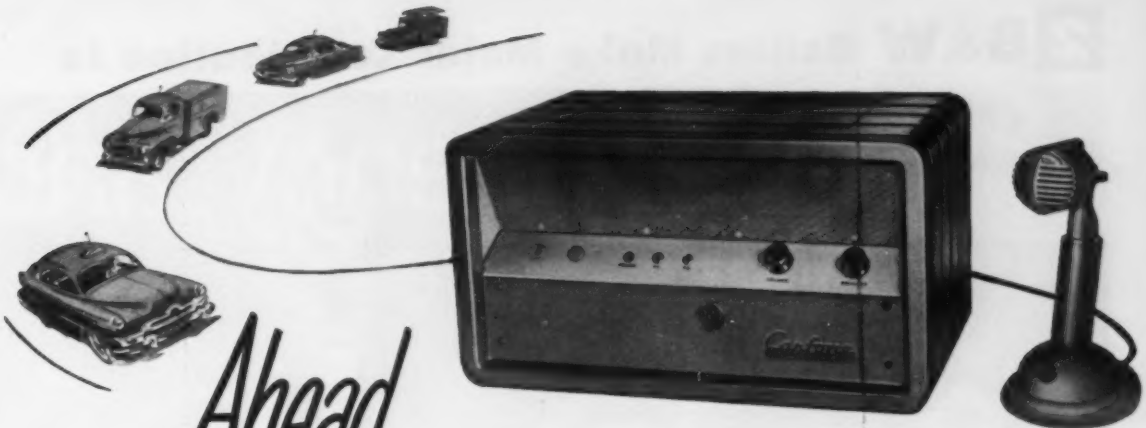
★ *BLANK NUT IS PURCHASED, BUT IS THREADED AND INSPECTED BY RELIABLE*

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES



# Ahead

*...in Styling!...in Performance!*

## New RCA Carfone ONE FIFTY 2-Way Radio

Performance-wise, as well as appearance-wise, this is the finest 2-way radio equipment that RCA has ever offered. Engineered for top performance, clearest voice reception, minimum maintenance and low-cost servicing, its features represent planning that is years ahead.

Among the built-in advantages you'll welcome now and benefit from in the years to come . . .

**IN THE DESK STATION**

- Styled for convenience
- Best frequency stability, without ovens
- Rainbow Tuning—color directed, all top adjustments
- Dual frequency operation, if needed
- Full coverage of 148-174 mc—without change of components

**IN THE MOBILE UNIT**

- Complete 6-12 volt convertibility
- Best frequency stability, without ovens
- Fewest tube types and fewest tubes
- Single Vibrator power supply
- Sealed Selectivity
- Most compact

*"Get the Best!"*

RCA DISPATCHER 2-WAY RADIO TO DRIVER

**MAIL COUPON BELOW FOR MORE DETAILS**

RCA®

**RADIO CORPORATION of AMERICA**

COMMUNICATIONS EQUIPMENT CAMDEN, N.J.

Radio Corporation of America
Communications Equipment
Dept. N-45, Building 15-1, Camden, N.J.
Please send me information on the new RCA Carfone "150" 2-Way Radio.

NAME_____

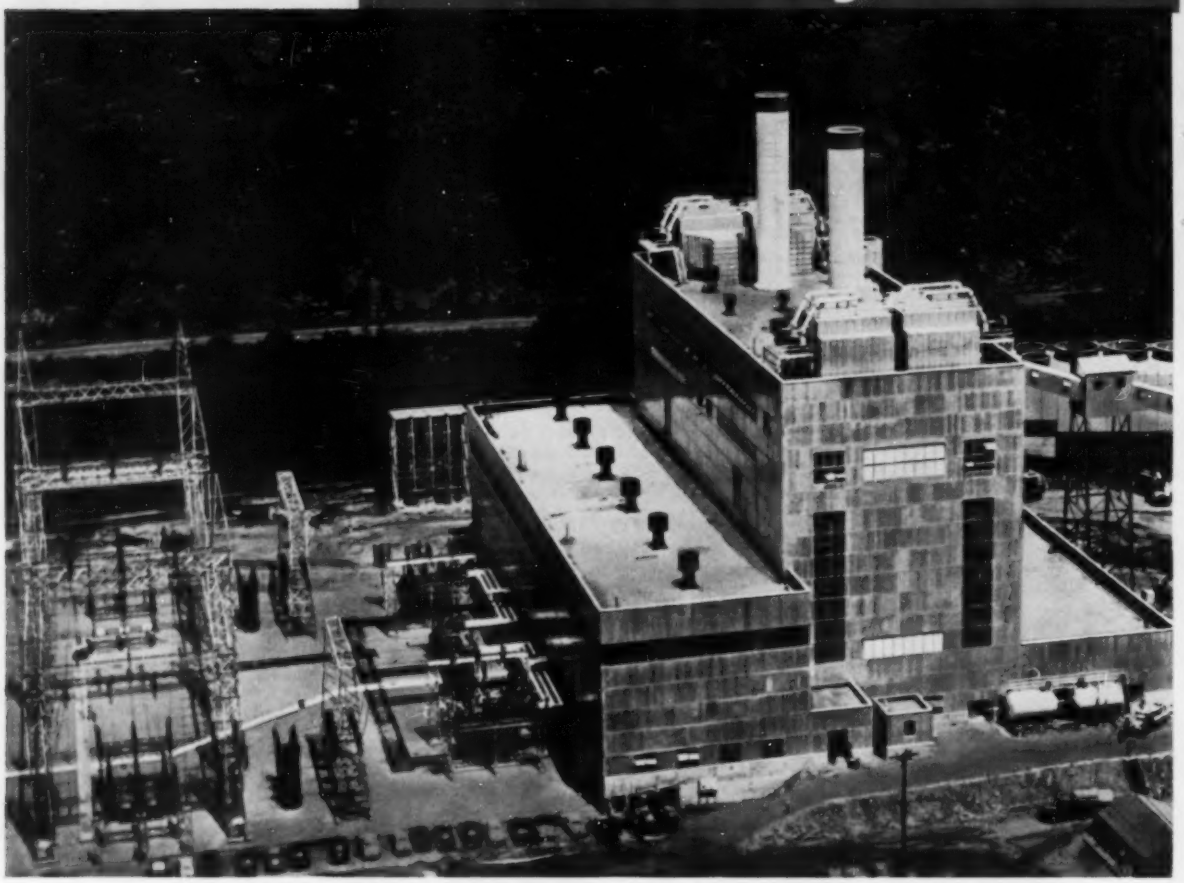
TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

# 2 B&W Boilers Make Major Contribution to efficiency and



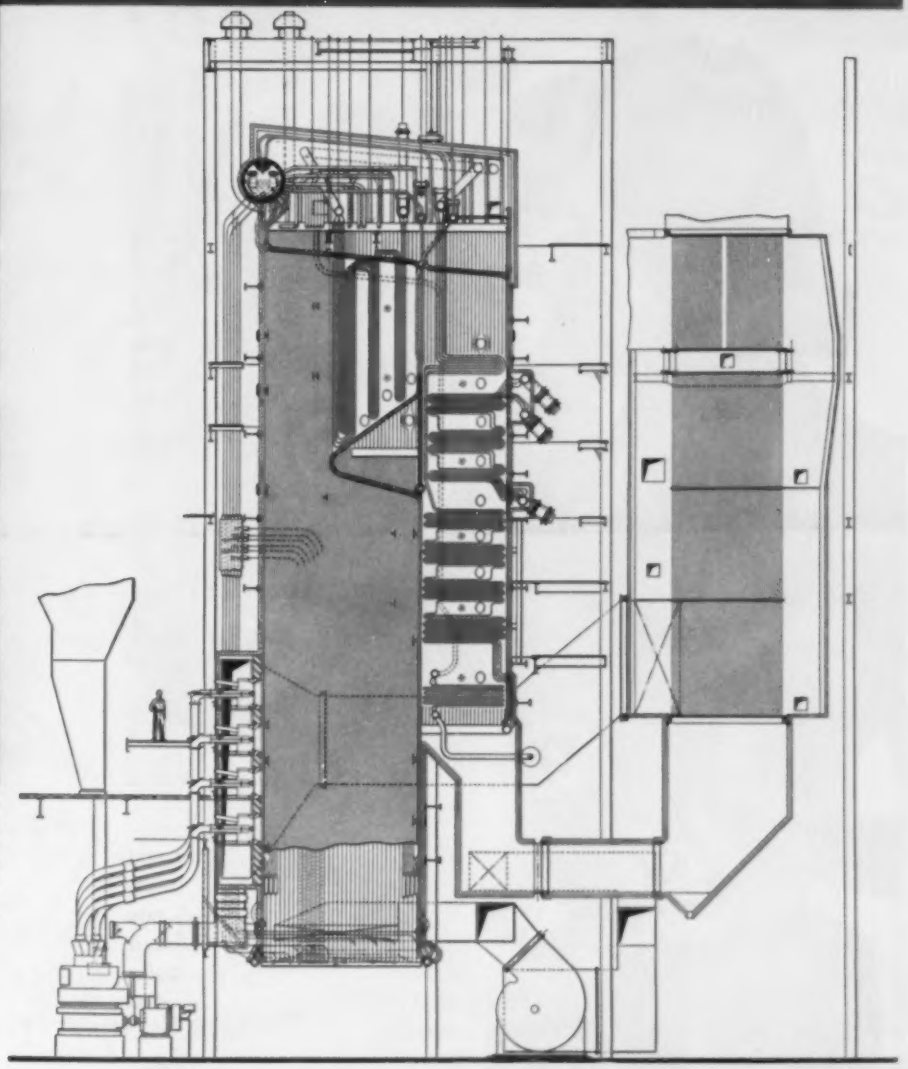
Utilizing design improvements developed to increase power generation efficiency and raise the level of unit availability, Pennsylvania Electric Company's new Shawville Station truly typifies power progress while demonstrating Penelec's awareness of future requirements in the area it serves. Currently operating as a two-unit plant, Shawville Station will eventually be expanded to 4 units and have a capacity totalling more than 500,000 kw.

Another addition in General Public Utilities' expansion program, Shawville Station is situated in coal fields near the center of Penelec's system load. Its two identical B&W Radiant Reheat Boilers have a design pressure of 2080 psi and a combined steam capacity of 1,788,000 lb per hr. These units include B&W Cyclone Steam Separators for natural circulation and each is equipped with 16 burners served by 4 B&W Pulverizers. This installation also includes B&W tubular airheaters and B&W continuous-tube type economizers.

Modern in every sense, Shawville Station has already demonstrated its efficiency during the first months of operation. It is one more practical tribute to the unending efforts of progressive electric companies, consulting engineers and B&W boiler experts working cooperatively to further advance the science of steam-electric power generation.

# high availability
## at SHAWVILLE STATION

Shawville Station of the Pennsylvania Electric Company. Engineering design and construction supervisory services by Gilbert Associates, Inc.



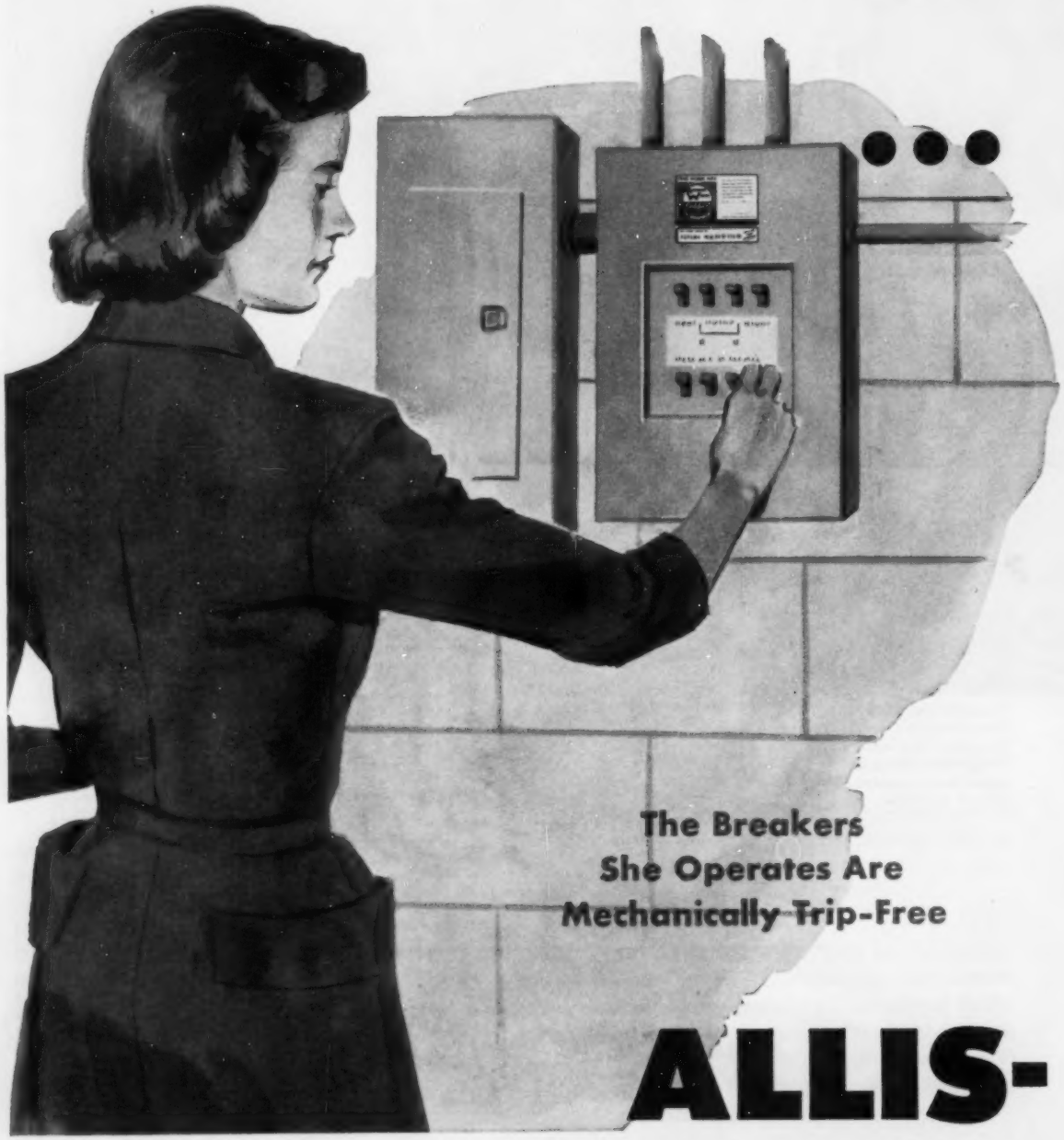
One of two identical, dry-bottom B&W Radiant Boilers now supplying steam at Shawville. Steam capacity is 894,000 lb per hr per unit. Steam pressure is 1900 psi at the superheater outlet and temperature is 1055 F with reheat to 1005 F.

BABCOCK & WILCOX

BOILER DIVISION

O-687

# Safe Breakers Mechanically



**The Breakers She Operates Are Mechanically Trip-Free**

**ALLIS-**

# are Trip-Free

# are yours?

The breaker shown is 230 kv, 10,000,000 kva.

Only Allis-Chalmers builds *all* breakers mechanically trip-free *without qualification*. Only in mechanically trip-free breakers are contacts and mechanism uncoupled — enabling contacts to open without restriction from mechanism.

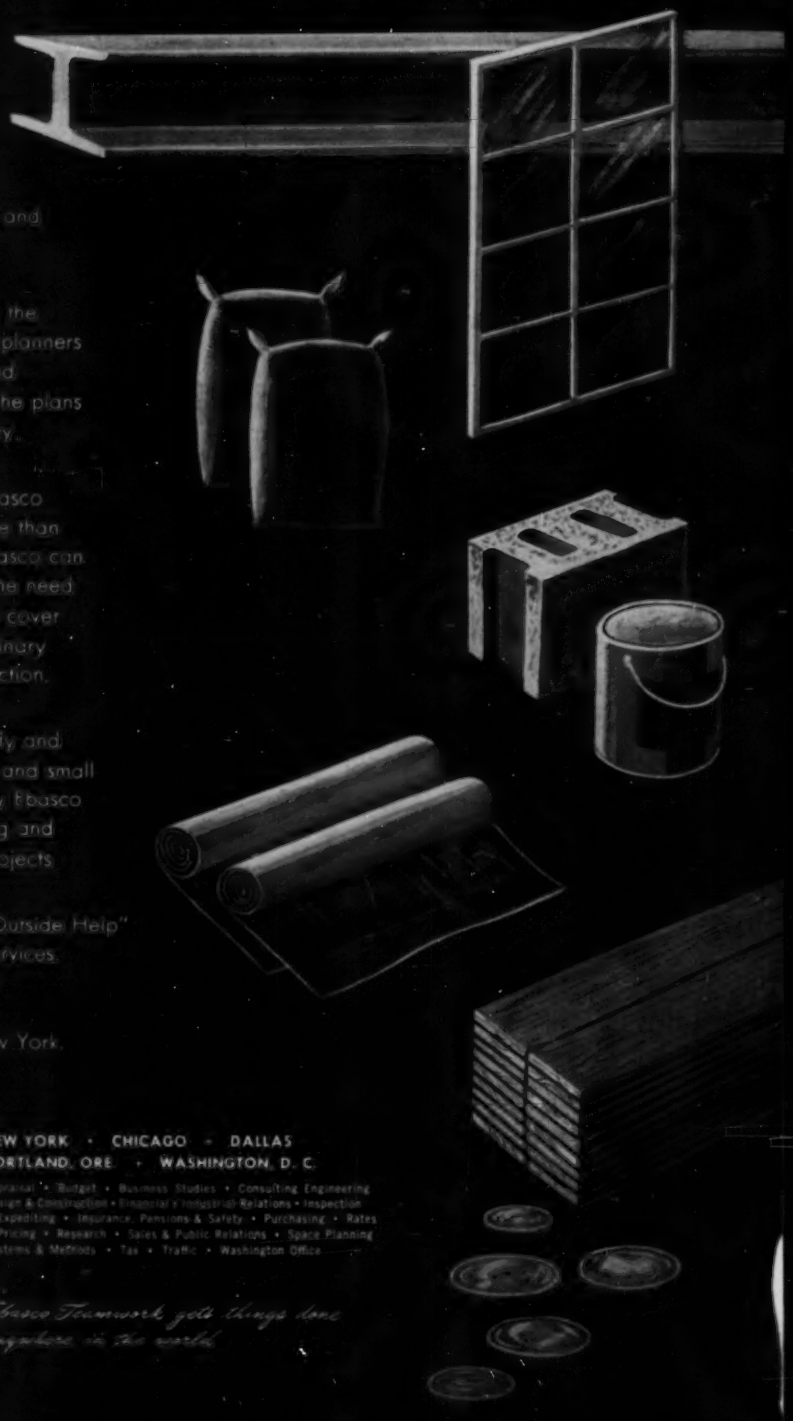
For information call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4506

# CHALMERS

A-C ALLIS-CHALMERS

# what are new plants made of?



Into a new plant go steel and glass and concrete—machines and metals, manpower and money.

More important, however, is the skill, the experience and the resources of the planners and constructors. The engineering and construction firm that stands behind the plans of a new plant may well hold the key to its future success.

Over its half-century of existence Ebasco has engineered and constructed more than two billion dollars of new plants. Ebasco can be brought into action the moment the need for new facilities is recognized—can cover every step from site selection, preliminary planning, engineering, actual construction, right through initial plant operation.

Our services are available, practically and economically, in building both large and small projects. Every new plant handled by Ebasco receives the same quality engineering and construction—the mark of Ebasco projects all over the world.

Our booklet—"The Inside Story of Outside Help"—tells the story of Ebasco and its services. For a copy, without obligation, write Ebasco Services Incorporated, Two Rector Street, New York 6, New York.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

NEW YORK · CHICAGO · DALLAS
PORTLAND, ORE. · WASHINGTON, D. C.

Appraisal • Budget • Business Studies • Consulting Engineering Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance, Pensions & Safety • Purchasing • Rates & Pricing • Research • Sales & Public Relations • Space Planning Systems & Methods • Tax • Traffic • Washington Office

*Ebasco Teamwork gets things done anywhere in the world*

# Specify ANDERSON

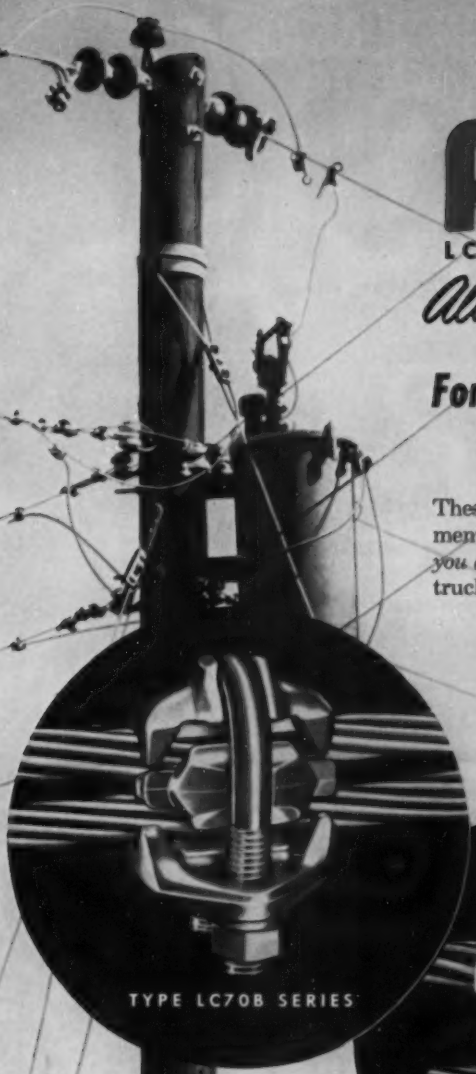
LC50 - LC500 - LC70B SERIES

## *Aluminum* CONNECTORS

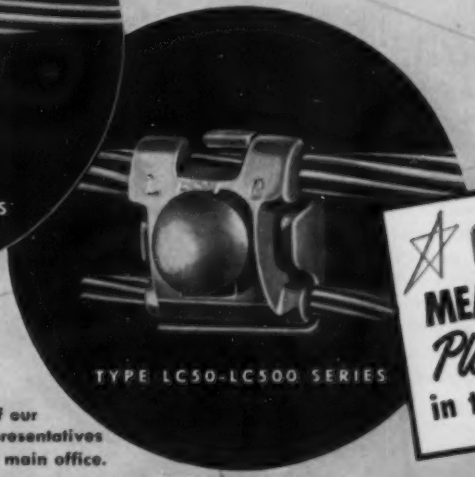
### For WIDER APPLICATION on Aluminum Distribution Systems

These Anderson Connectors will eliminate the large assortment of types and sizes you are now using—*and still give you a wider range of application.* They save costs . . . reduce truck inventory . . . save time on the job.

| CATALOG NO. | MAIN | TAP |
|---|---|---|
| LC-51A | No. 6—1/0 ACSR | No. 6—No. 2 ACSR |
| LC-52A | No. 6—1/0 ACSR | No. 6—1/0 ACSR |
| LC-511A | No. 6—1/0 ACSR | No. 8—No. 2 COPPER CABLE |
| LC-522A | No. 6—1/0 ACSR | No. 8—1/0 COPPER CABLE |
| LC-70B | No. 6—No. 2 ACSR | No. 6—No. 2 ACSR |
| LC-71B | No. 6—1/0 ACSR | No. 6—1/0 ACSR |



TYPE LC70B SERIES



TYPE LC50-LC500 SERIES

Consult one of our nearest 20 representatives or contact our main office.

☆ ABW DESIGN MEANS QUALITY *Plus* STRENGTH in the RIGHT PLACES!

ABW

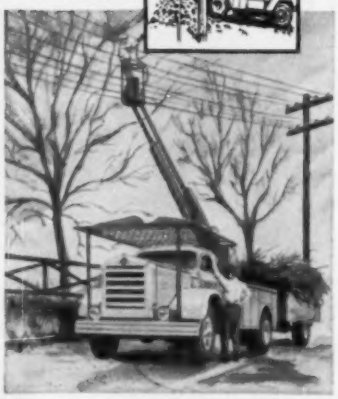
*Aluminum & Bronze* POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

**CUSTOM-ENGINEERED**—**More Tractive Power —Less Dead Weight—through Stronger, Lighter Alloy Steels and Advanced Math-Matic Design!**

This basic unit of heavy-duty driving power is designed to out-perform mass produced, mass marketed trucks on the basis of extra power, dependability and economy of operation. Advanced *Math-Matic Design*—in every feature of FWD—correctly proportions power to weight on front and rear axles . . . makes every pound of load help haul itself, turns every ounce of power into more controllable traction and greater steering safety. You'll find FWDs shouldering more than their share wherever there's tough, heavy work to be done. Let us show you how FWD fits into *your* picture . . . contact your FWD Dealer today!

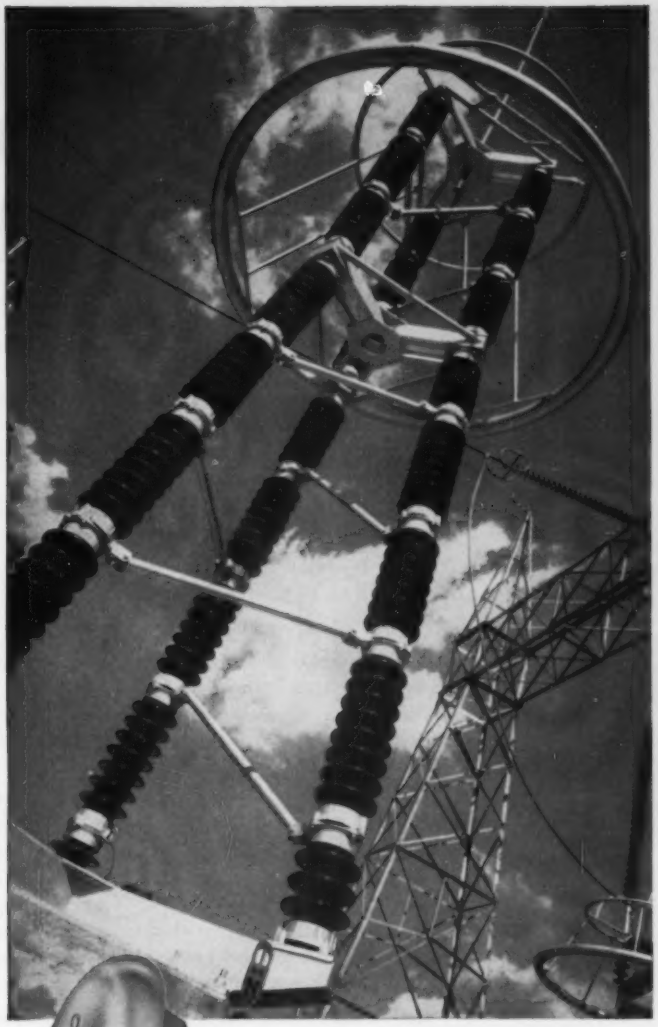


BUILDERS OF AMERICA'S FWD FOREMOST HEAVY-DUTY TRUCKS

MATH-O-MATIC DESIGN

Write for informative, illustrated folder on FWD units in the weight category you normally use. Four and six wheel drive trucks from 14,500 to 60,000 lbs. G.V.W.

**THE FOUR WHEEL DRIVE AUTO COMPANY,** CLINTONVILLE, WISCONSIN, *Canadian Factory,* KITCHENER, ONTARIO



# ARRESTED!

**Costly Corrosion**
**Costly Breakdowns**
**Costly Complaints**

# ARRESTED BY HARPER FASTENINGS!

Whatever your equipment—whatever the corrosive agent—you get added insurance... you're assured trouble-free performance from Harper Everlasting Fastenings.

They're made exclusively from the corrosion-resistant metals. They're available without delay in a wide range of types, sizes and alloys. More than 7,000 different items are carried in stock.

Protect your equipment, prolong its life. Harper Fastenings can meet *all* your requirements. Call the Harper Branch Office or Distributor near you, or write for helpful information.

THE H. M. HARPER COMPANY
8205 Lehigh Avenue
Morton Grove, Illinois

**BOLTS • NUTS • SCREWS • WASHERS**
**RIVETS • STUDS • SPECIALS**
**of**
**SILICON BRONZE • COPPER • ALUMINUM**
**NAVAL BRONZE • BRASS • MONEL**
**NICKEL • ALL STAINLESS STEELS**

**World's largest self-supporting lightning arrester. Designed by Westinghouse Electric Corporation. Being used to gain more data about corona and the transmission of high voltage electricity.**

*⅜"—11 x 3*
*Oval Neck*
*Silicon Bronze*
*Connector Bolt*

HARPER
EVERLASTING FASTENINGS

SPECIALISTS IN ALL CORROSION-RESISTANT FASTENINGS

The H. M. Harper Company
8205 Lehigh Avenue, Morton Grove, Illinois
Please send me:
☐ Catalog 25 ☐ Aluminum Fastenings Catalog
*Name*.....
*Position*.....
*Company*.....
*Address*.....
*City*.....*Zone*.....*State*.....

# New 7½ kvar, 240-volt capacitor does 3 critical jobs

Throughout your distribution system, secondary capacitors can provide a much needed lift where low power factor and overloaded transformers are a problem.

Three important jobs Westinghouse Inerteen® capacitors can do for you are:

1. Increase peak load thermal capacity
2. Reduce load losses
3. Improve voltage

Extensive studies have proved that capacitors . . . whether mounted singly or banked, whether used with voltage regulators or without . . . provide added load capability at considerably less cost than alternative means.

Now, for higher rated transformers, Westinghouse has developed the 7½ kvar unit. No longer and only slightly wider than the 5 kvar unit, it has a heavy-gauge, extruded-aluminum tubular case, averaging 40% lighter than conventional units. Lower first cost, lower installation and maintenance costs together mean that you get lower cost kilovars with Westinghouse capacitors.

Call your Westinghouse sales engineer, or write for the technical paper, *Application of Secondary Capacitors on Overhead Systems,* to Westinghouse Electric Corp., 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60874

YOU CAN BE SURE... IF IT'S
Westinghouse

# Know the family of ALATHON® polyethylene resins for insulation and jacketing materials

- ✓ *Higher-temperature ceiling*
- ✓ *Lower-temperature floor*
- ✓ *Greater toughness*
- ✓ *Longer weather resistance*
- ✓ *Low dielectric loss*
- ✓ *Low water absorption*

Your copper or aluminum conductors have the very best protection when covered with one of the family of "Alathon" polyethylene resins. Insulation and jacketings of Du Pont "Alathon" have outstanding dielectric properties. Linemen find wire jacketed with "Alathon" easy to handle, lightweight, and pliable.

The heat resistance of "Alathon" is superior to any other polyethylene on the market. Tough, weather-resistant insulation and jacketing of Du Pont "Alathon" assures long service life.

For additional information, clip and mail the coupon below.

There is a difference in polyethylenes—

specify **ALATHON®**

polyethylene resin

DU PONT

REG. U. S. PAT. OFF.

**BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY**

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 352, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for

_____

Name_____

Position_____

Firm Name_____

Street Address_____

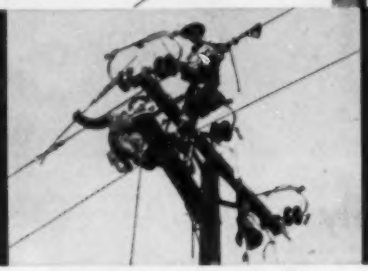
City_____ State_____

Type of Business_____

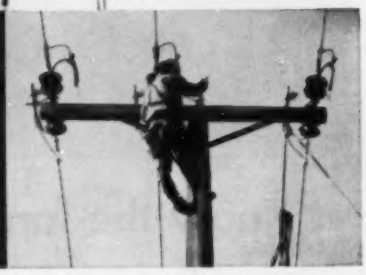
# KPF AIR BREAK SWITCHES

1 Sturdy factory-assembled phase units are bolted to cross-arm and push-pull interphase control rods installed on the ground. (Installation is equally simple in the air on installed cross-arms.)

2 At pole-top, lineman receive switch bolted to cross-arm and ready to install on pole. Simple design and use of quality materials means KPF phase units are rugged, yet amazingly light weight.



3 Cross-arm bolted to pole, braces and first section of control rod installed. Linemen connect conductors quickly and easily to any standard strain clamp and dead-end direct to phase units.



4 Conductors connected, crank arm being adjusted on push-pull interphase control rod. Like KPF switches and Quick-Breaks, KPF controls need no lubricating. They crack off any icing, are never affected by cross-arm warpage.

## Time-tested KPF switches install simply, easily—in 1/2 normal time

KPF switches—the switches that look different because they *are* different—install differently, too. Experience of leading Western power companies shows that KPF switches are normally installed in ½ the time required for complex, cumbersome ordinary equipment. Each KPF phase unit is light weight, readily handled by one man. No extra cross-arms or special supporting structures are needed. Each phase unit is fully assembled, tested and adjusted at the factory. The unit is ready to operate when it reaches the job—no waste of lineman's time. Dependable KPF switches may be mounted horizontally, vertically or triangularly with equal success and long-term, trouble-free service.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

**KPF**
**AIR BREAK SWITCHES**
*Standard for nearly half a century*

New catalog gives complete specifications, detail drawings, installation data.

5 Installation complete. Lineman installs operating lever and last section of control rod. Note the neat, clean pole top appearance of KPF switches—a familiar sight throughout the West on such famous systems as PG&E, Southern California Edison and others.

**KPF ELECTRIC COMPANY**
1624 East Alpine Avenue, Dept. E, Stockton 5, California

On-time start-up at Cutler station underscores how . . .

# G-E teamwork can help meet operation schedules, lower power plant costs

When Florida Power & Light and Ebasco Services selected General Electric apparatus for expansion of the Cutler Station near Miami, they soon realized the value of having a G-E project team to help them. G-E Project Service will help keep plant construction costs to a minimum, and help meet start-up schedules and operating commitments through on-time apparatus shipments.

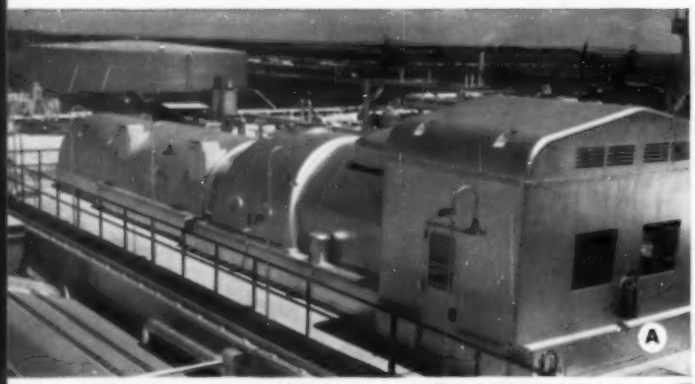
To get full details on how you can benefit from G-E Project Service, contact your nearest G-E Apparatus Sales Office. For further data on how this service paid off for Florida Power & Light in expanding its Cutler Station, see the following pages.

GENERAL ELECTRIC

PROJECT SERVICE REPORT

**TWO G-E TURBINE-GENERATORS PRODUCE** 130,000 kw at Cutler Station of Florida Power and Light Co., Miami, Fla., to handle rapidly increasing industrial and residential loads of this growing area. Throughout construction, F. P. & L. and their consultants, Ebasco Services, Inc., received consolidated project reports on manufacturing details and shipping dates of all major electrical equipment.

# General Electric helps Florida P. & L. keep



A

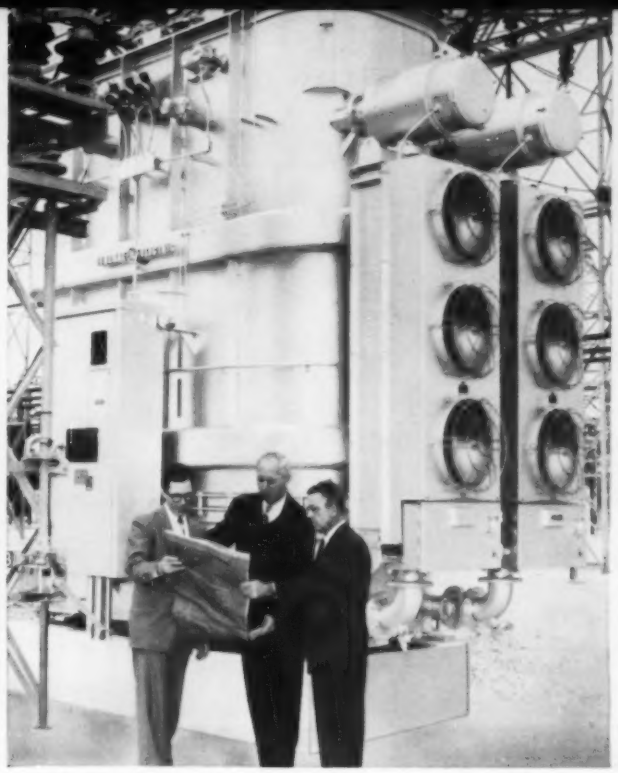
B

C

**A TURBINE-GENERATOR,** 80,000 kilowatts, the newest G-E unit at Cutler Station, is tandem-compound, double flow, 3600 rpm. Manufacturing time was kept to a minimum since early planning reserved factory space.

**B ADDITIONAL CAPACITY** is already on order for F. P. & L. to meet Florida's rapid growth. President R. H. Fite (center) of F. P. & L. discusses the installation of a new 135,000-kw G-E unit (going in service next year) with J. W. Lacy, G.E., and H. V. Street, F. P. & L's. Chief Engr.

**C SYSTEM REQUIREMENTS** are discussed by F. P. & L.'s H. W. Page (left), Manager Power Supply and George Kinsman, Vice President. Early planning with G-E Project Team helped F. P. & L. meet growing power requirements on time.



**MAIN POWER TRANSFORMER** is forced-oil air-cooled, 42,500 kva. L. H. Hill, Jr. (left), G-E Transformer Specialist, E. J. Pearch, Station Supt. and J. W. Lacy, Jr., G-E Office Manager, discuss time saved by upright shipment in one-piece tank.

**EBASCO SERVICES** confers in New York with G-E Sales Engineer W. Luxton. Left to right: F. A. Ritchings, Chief Mechanical Engineer, W. H. Colquhoun, Engineering Manager, Mr. Luxton, and H. L. Lowe, Chief Electrical Engineer.

**OUTDOOR SWITCHGEAR** connections are reviewed by E. A. Bird, Ebasco Const. Supt., W. J. Blad, G-E Service Engineer, and Mr. Pearch. Project Co-ordination greatly simplified scheduling of numerous components.

# ahead of growing power requirements

## Project co-ordination by G.E. on 80,000-kw addition to Florida Power and Light's Cutler Station proves planning, teamwork pay-off

Cutler Station of Florida Power and Light, located near Miami, is an outstanding example of the utility industry's bold answer to the problem of sky-rocketing load growth in many areas. General Electric worked with F. P. & L. and its consulting engineers, Ebasco Services, Inc.—co-ordinating application engineering, product specifications, manufacturing and design cycles and scheduling of electrical equipment deliveries to help make sure the station went on the line on time.

In the expansion of this outdoor station, as in many stations throughout the country, Project Co-ordination has demonstrated its contributions to the planning, engineering, and successful operation of electric utility generating plants.

Such project co-ordination, combining the utility, the consultant and G.E.'s team of sales engineer, product specialists, application engineers and field service engineers, can save you time, money and man-hours. ***Here's how:***

**SIMPLIFY ORDERING OF EQUIPMENT,** purchased either directly, or through your consulting engineers, or through a machinery manufacturer.

**CONSERVE ENGINEERING TIME** by co-ordinating mechanical details which frees you and your consulting engineers for other urgent problems.

**INTEGRATE EQUIPMENT DESIGN** to insure the maximum flexibility and effectiveness of plant operation.

**SPEED CONSTRUCTION** by scheduling the arrival of equipment for maximum installation efficiency.

**SUPERVISE INSTALLATION AND HELP TRAIN OPERATORS** to insure minimum start-up time and better understanding of the full operating capabilities of the equipment.

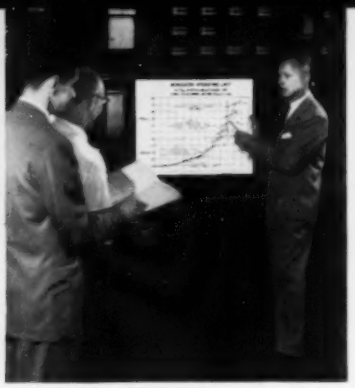
For details contact your G-E representative, or write Section 302-5, Apparatus Sales Div., General Electric Co., Schenectady 5, N. Y.

**GENERAL ELECTRIC**

***For More Data on How G-E Engineering Teams Work for You, See Next Page . . .***

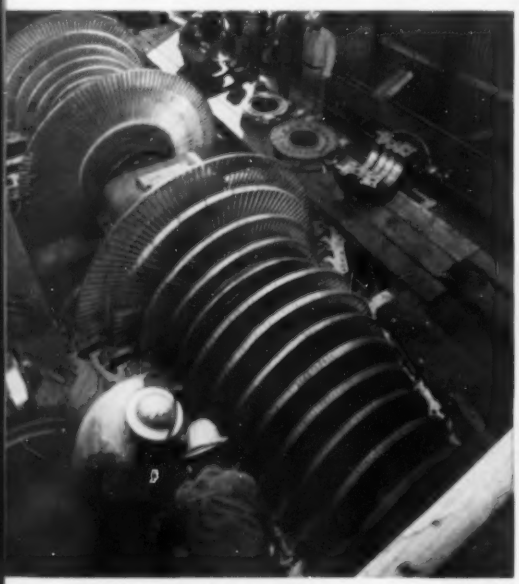
**DISTRIBUTION PROBLEMS** are quickly solved by portable d-c network analyzer. Developer J. F. Fuller, one of 41 district electric utility application engineers, works exclusively on utility problems.

**ENGINEERING FORUMS** explore latest developments and system trends, bring C. E. Kilbourne, generator engineer together with S. R. Folger, Philadelphia, and G. W. Walsh, headquarters, application engineers.



**APPLICATION ENGINEERING** services back up 325 sales engineers. H. C. Anderson, headquarters application engineer, explains maximum station output within stability limits.

**BETTER SYSTEM PROTECTION,** improved performance come from G-E Transient Analyzer studies. Here, A. J. Schulz, L. B. Johnson of G-E Analytical Engineering check effect of lightning surges on 100,000-kw generator.



**FAST, PRECISE INSTALLATION** is result of putting detailed planning into practice. For utilities, such planning by 200 G-E Field Service Engineers and 200 product specialists helps cut installed cost, speed start-up.

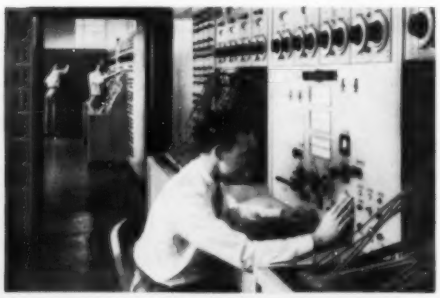
## Here's how engineering teamwork helps utilities by

# Translating creative thinking into profitable system operation

Co-operating with electric utilities and consulting engineers, General Electric's network of engineers is backed by the Company's vast resources. An application and analytical engineering center in Schenectady, for example, permits objective examination of creative new ideas and critical evaluation of projected system performance.

Continuing services by nearly 1000 G-E utility sales and engineering specialists are helping assure that today's bold investment in the future will be sound and profitable.

The practical working knowledge of G-E engineers, plus special analytical equipment and techniques, help electric utilities meet present and future power demands on a sound business basis. General Electric Co., Schenectady 5, N. Y.



**EFFICIENT SYSTEM PLANNING** with G.E.'s two a-c network analyzers is made possible since units accurately predict characteristics of systems performance. These analyzers, individually or in combination, are in almost continuous use solving electric utility system problems.

**ELECTRONIC COMPUTERS** quickly analyze transmission loss studies to provide new information on economical utility system operation for F. J. Maginniss, Mgr.–Special Investigations and Dr. L. K. Kirchmayer.

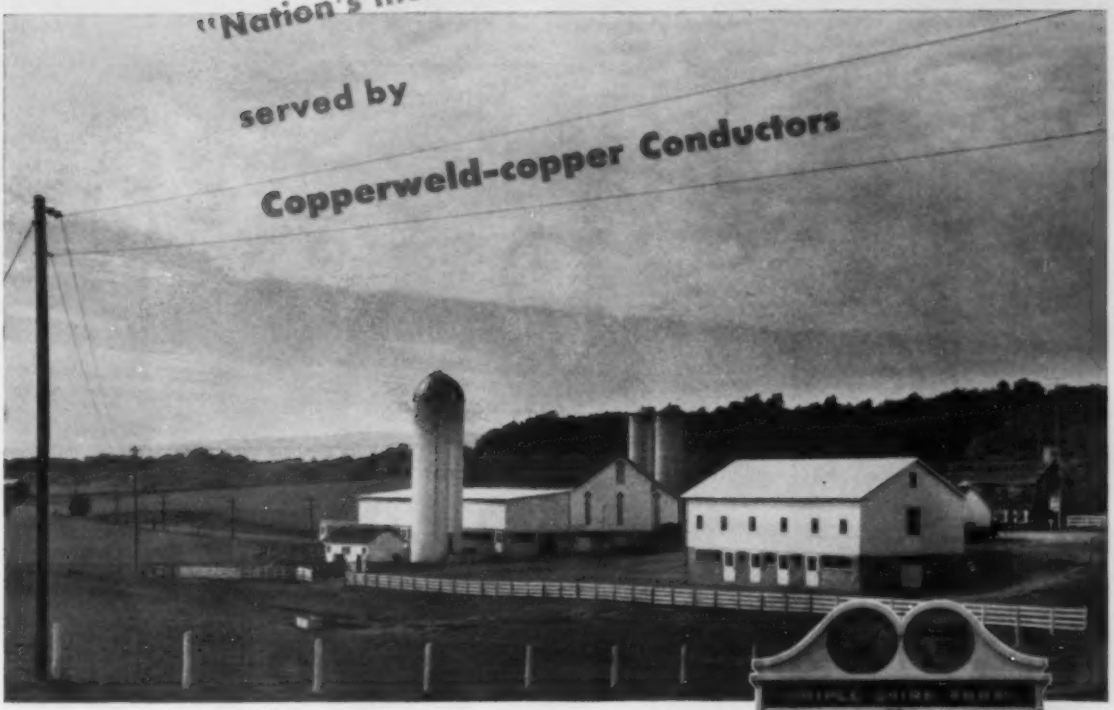
*MORE POWER TO AMERICA*

**GENERAL ELECTRIC**

"Nation's most highly electrified farm"

served by

Copperweld-copper Conductors




This sign designates Light's Diamond Jubilee Farm. Truly representative of electrical progress in agriculture, this 398-acre farm is served by the Pennsylvania Power and Light Company.

At the Light's Diamond Jubilee Farm of John Stamy, Jr., located in Cumberland County, Pa., just about everything depends on electric power. The multitude of electric equipment used by Mr. Stamy consumes five times as much power as the average farm—ten times that of the average urban home.

It's not surprising that Copperweld*-copper Conductors are being used to carry reliable power to the "most highly electrified farm in the country," because they're the best conductors for rural distribution lines.

When you build with Copperweld-copper Conductors, you know you always have simple, economical copper-to-copper connections that pay off in longer life, less maintenance, better electrical performance and uninterrupted service.

*Trade Mark

*Write today for the Copperweld Engineering Data Book*

**COPPERWELD STEEL COMPANY**

**WIRE AND CABLE DIVISION, Glassport, Pa.**

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

**YOU, TOO, CAN DEPEND ON**

Copperweld-copper

TRADE MARK

**POWER CONDUCTORS**

POPULAR TYPES FOR TRANSMISSION AND DISTRIBUTION LINES

*Ljungstrom field engineers assure you of maximum return on your preheater investment*

Your Air Preheater Corporation field engineer aims to visit your installation at least once a year. It's his job to give you the help and advice you need to assure you of maximum return on your Ljungstrom Air Preheater investment.

This field service is another factor in making the Ljungstrom the most economical heating surface on the modern boiler. And it helps explain why 7 out of 10 modern preheater installations are Ljungstroms.

Get all the details on the Ljungstrom Air Preheater. Why it cuts fuel costs . . . helps maintain higher boiler efficiencies . . . why it speeds cleaning and maintenance. You'll find all the details in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for your free copy, today!

**Advantages of the Ljungstrom Air Preheater**

- Size-for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

**The Air Preheater Corporation** 60 East 42nd Street, New York 17, N. Y.

**TYPE SM-5 CURRENT TRANSFORMER (indoor service)**

# Molded in silicone— lightest, smallest, most durable 5-kv unit built!

The Westinghouse Type SM-5 current transformer is silicone insulated throughout—has a rating factor of 1.5 and has 0.3 accuracy class for all metering burdens—meets all ASA and NEMA Standards—yet is smaller, lighter and more durable than any 5-kv unit built to date.

*The exclusive new silicone-base insulating material* is permanently molded to the core-coil assembly—is impervious to atmospheric condition—has high dielectric strength, low insulation power factor, high resistance to electric creepage, abrasion or rough handling. It does not age under temperature, sunlight or humid conditions.

Exclusive Hipersil® Type C cores, complete mounting flexibility, an automatic or manually operated short-circuiting device, silver-plated primary terminals and other equally outstanding design features make the SM-5 the leader in its class.

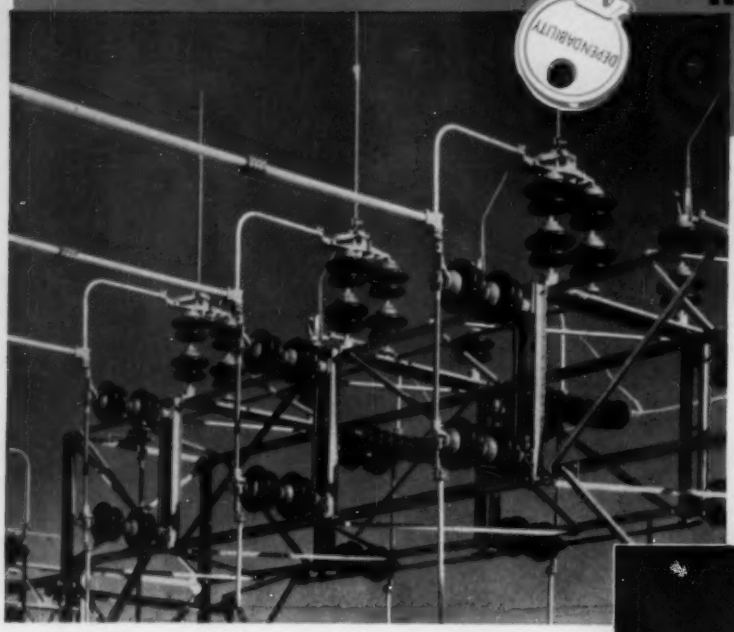
Get full details now from your local Westinghouse representative or write direct for booklet B-6396 Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70733

YOU CAN BE SURE...IF IT'S

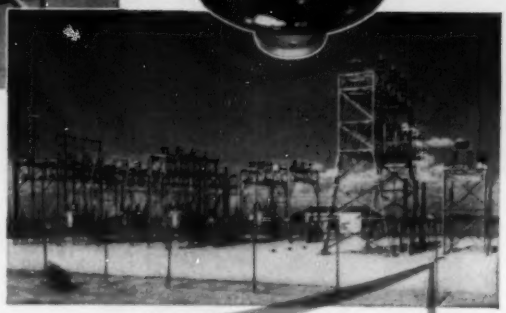
Westinghouse

# DEPENDABILITY KEY TO ROBUST GROWTH

## for Southwestern Public Service Co. . . . and PORCELAIN PRODUCTS, INC.



Catalog No. 69169
TDJ—58
TR—16



The new Roswell Interchange Substation is a typical example of foresightedness shown by the management and engineering staff of Southwestern Public Service Company. Shrewdly planning and developing area needs, SPSCO has increased its load 320% in the past nine years and anticipates doubling this by 1958.

Such robust growth can be achieved only through dependable service, skillful management practices and engineering demands for equipment and components that unfalteringly deliver a full measure of service—PLUS.

Southwestern Public Service Company is one of many leading power companies specifying and using *PORCELAIN PRODUCTS' APPARATUS INSULATORS.*

### DEPENDABILITY

**BECAUSE**—We build your Apparatus Insulators to last forever.
**FINEST WET-PROCESS PORCELAIN**—quality controlled, assures long life.
**STANDARD HARDWARE COMPONENTS**—assures interchangeability.
**PRECISION JIG ASSEMBLY**—assures perfect alignment, saves mounting time.
**STATIONARY JIGS**—prevent movement while curing cement.
**RUGGED DESIGNS**—give extra factors of safety.

*Quality You Can Trust*

YOUR INDEPENDENT INSULATOR MANUFACTURER

61 years

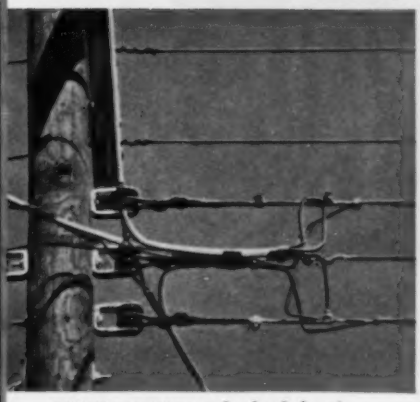
**Porcelain Products, Inc.**

PP —INC.—

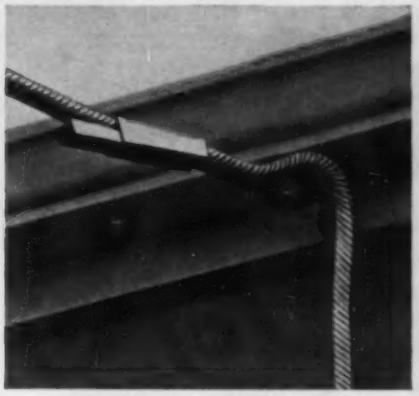
PARKERSBURG, WEST VIRGINIA

Export Representative:
Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.

**ANACONDA'S TYPE K** service drop cable. Tough aluminum ribbon covering over neoprene-insulated conductors reduces outages caused by foreign objects.



**POLE END OF CABLE** is deadended with aid of grip attached to secondary neutral bracket by service clevis.



**HOUSE END IS ATTACHED** by cable clamp and service hook. Type K cable bends without loosening ribbons to provide drip.

**DIRECT TO METER.** Type K may be installed from pole to outdoor meter without splice or tap where local ordinances permit.

# TYPE K SERVICE DROP ASSURES LONG TROUBLE-FREE OPERATION

To help cut trouble calls and costs, Anaconda offers Type K aluminum service drop cable for pole to meter run.

This cable gives long, economical service and reduces outages caused by foreign objects during wet weather.

Conductors of Type K are protected by tough, spirally wrapped flat bare aluminum neutral. This covering helps prevent tree limbs and other foreign objects from chafing through the insulation to the conductors and shorting the line.

Type K cable is light, flexible, easy to install. It is neat. And insulation of specially compounded neoprene gives excellent electrical properties.

Ask your Anaconda Salesman or Distributor for full information today. Or write Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

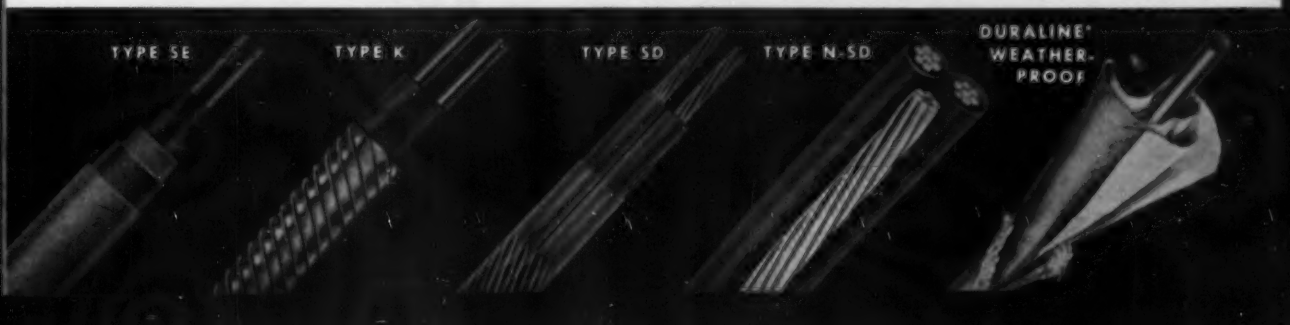
54397

**TYPE K service drop cable**

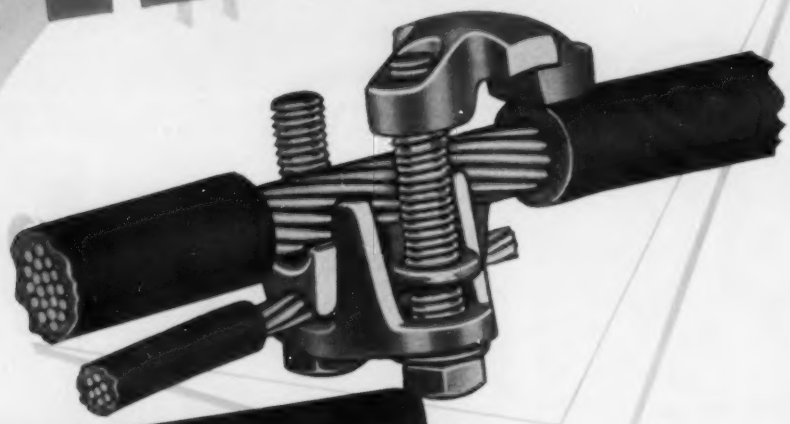
**ANACONDA®**

**Single source for every type service drop and entrance cable — in aluminum and copper**

Reg. U. S. Pat. Off.



# CUT DOWN INSTALLATION TIME² with



## BLACKBURN
*Hi Strength*
## TWO-BOLT CLAMPS

**One piece construction simplifies installation—eliminates assembly problems—no falling parts—no missing pieces—no special tools necessary. Available in copper or heavily tin plated—with or without contoured spacer.**

Long bolt is peened, capturing spacer and top casting. Spacer is ringed and swings easily over conductor. Free bolt is held in place by neoprene washer during installation.

Contoured spacer keeps conductor in original shape and distributes unit pressure over large area of conductor, minimizing cold flow and provides wide separation between the aluminum and copper conductor, reducing possibility of galvanic corrosion.

Shakeproof washers prevent loosening under the most severe operating conditions. Washers, castings, bolts and spacers are of copper alloy, completely tin plated.

**Write today for complete specifications and prices on Blackburn Two-Bolt Clamps.**

**JASPER BLACKBURN CORPORATION**
35 MADISON • ST. LOUIS, MO. • PHONE: MAIN 1-2821

# This Oval Window Holds Two 500 MCM Insulated Cables

## Get it in any rating!

**There is plenty of room for conductors** in Allis-Chalmers 600-volt outdoor-indoor current transformers. Every rating has this same big oval window 1⅜ by 2¼ inches — large enough to hold two 500 MCM stranded conductors with 600-volt insulation.

In addition, units are compact and lightweight. Install them singly or in multiple, in standard instrument transformer enclosures or outdoors. You can mount them in any position — they have special provision for different methods of mounting. It is possible to get a number of ratings from a single unit by passing primary conductor through window more than once. Type TWM transformers come in the following ratings: 200 to 5 amp, 400 to 5 amp, 600 to 5 amp, and 800 to 5 amp.

Get all the facts. Ask your nearby A-C office for a copy of 61B8080 or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4546

Short-circuiting device on terminal block in open-circuited position.

Cover will fit over terminal block only if straps are turned in proper position.

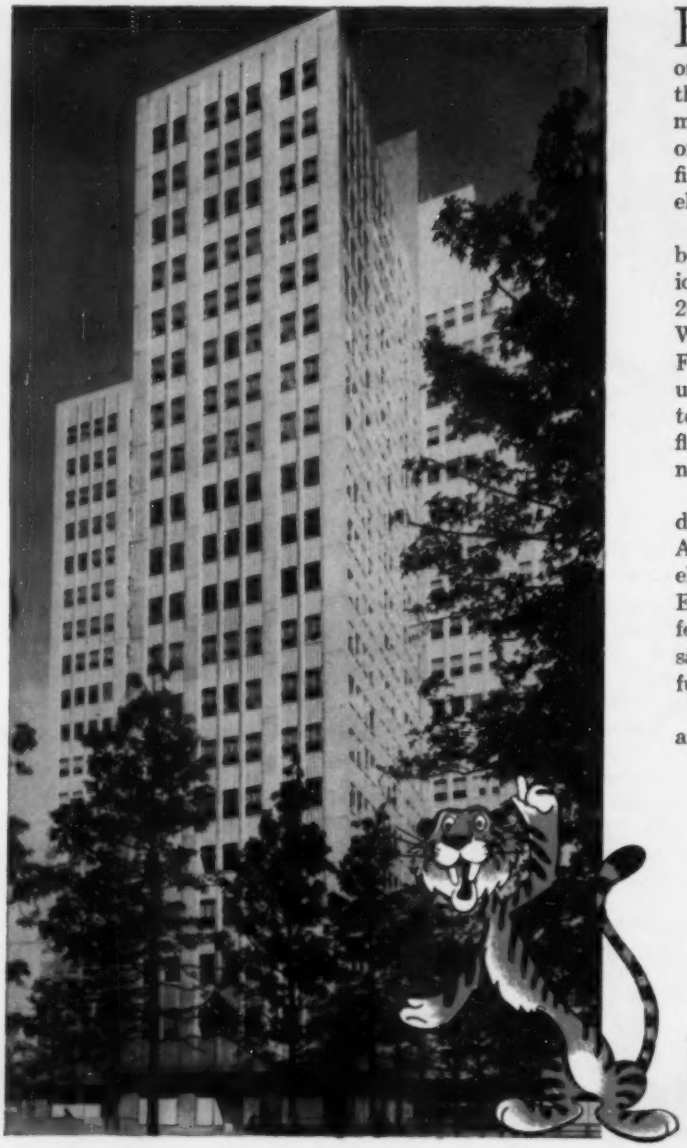
### Removable Short-Circuiting Device... Can be Added to Units in Service

A useful operating option has been added to Allis-Chalmers thru-type current transformers. A short-circuiting device fits the secondary terminal block: with straps turned to short-circuiting position, cover cannot be replaced. Device is supplied on all units, can easily be removed if desired. It is readily adaptable to any transformer in service.

A-C

# ALLIS-CHALMERS

# 6 miles of TIGER BRAND control the elevators in new Gateway Center buildings



ELEVATOR CONTROL CABLE leads a tough life. It must be light, to reduce the load on the car. It must be flexible, to withstand the continuous movement and vibration. It must be strong, to prevent the long length of cable from tearing itself apart. It must be fire-resistant, to guard against disastrous elevator shaft fires.

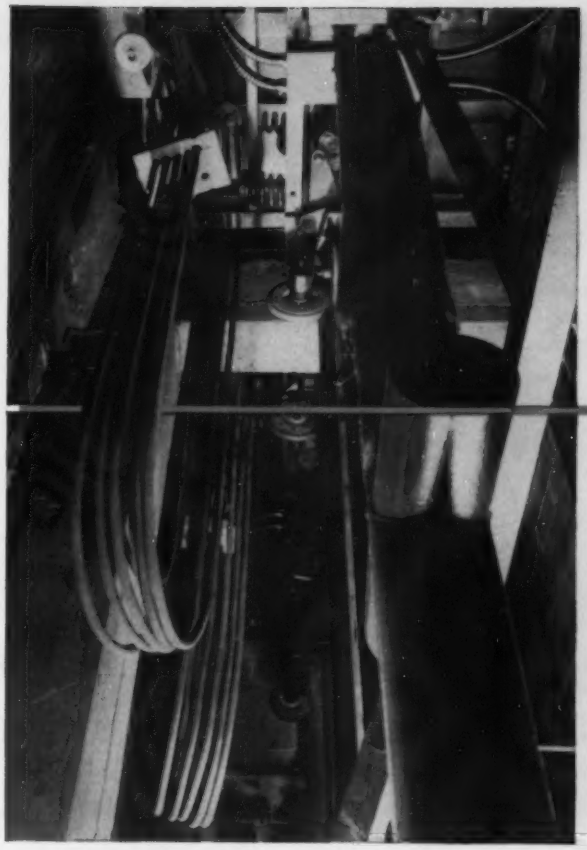
For the magnificent Gateway Center buildings in Pittsburgh, shown here, American Steel & Wire furnished some 6 miles of 20 and 30-conductor control cable for the Westinghouse Selectomatic elevators. Flame-resistant insulation and jackets are used, and each cable is reinforced with tough steel strands. The cable had to be flexible enough to withstand movement, but not so flexible that it would kink.

These are desirable features for many different kinds of electrical wire and cable. And although you probably don't build elevators, you can rely on any Tiger Brand Electrical product to combine all the subtle features that make for easy installation, safe, reliable operation, plus a long and useful life.

Send the coupon for more information on any Tiger Brand product.

**AMERICAN STEEL & WIRE DIVISION,**
**UNITED STATES STEEL CORPORATION**
**GENERAL OFFICES: CLEVELAND, OHIO**
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO,
PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.,
SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Gateway Center, famous Pittsburgh landmark, where Westinghouse Selectomatic Elevatoring matches calls, cars and floors to put elevators where they're needed, when they're needed.



Tiger Brand control cables are at the left. The hoist ropes, visible at right, are also made by American Steel & Wire.

Control cable terminal box is located half-way up the shaft. Flat steel rods projecting from elevator track actuate induction coil on car to control automatic leveling system.

## A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

paper & varnished cambric cable
asbestos wire and cable
aerial, underground & submarine cable
shovel & dredge cable
mold cured portable cord
machine tool & building wire
special purpose wire & cable

SEND THE COUPON

American Steel & Wire Division
Room EE-25, Rockefeller Building
Cleveland 13, Ohio

Please give me more information about Tiger Brand cable for .....

Name .....

Firm .....

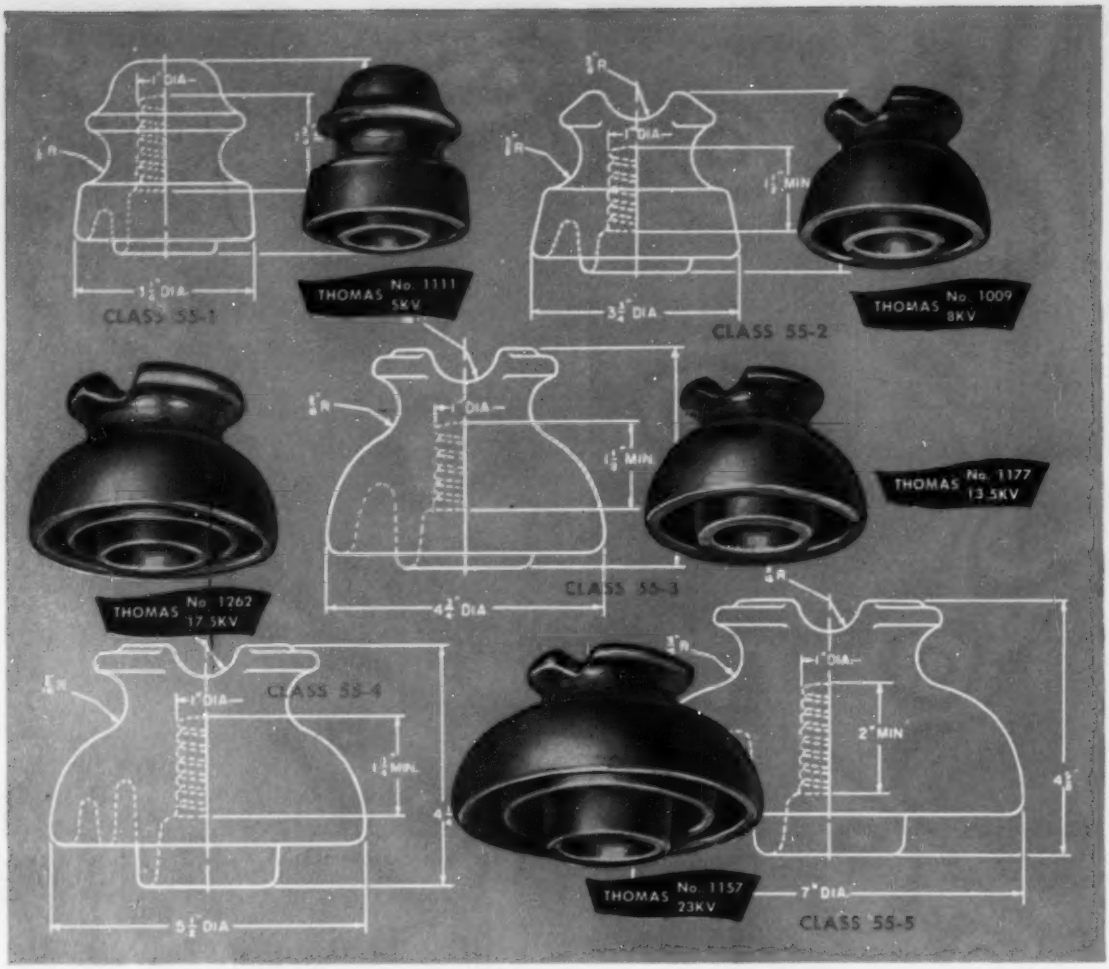
Address .....

City ..... State .....

**USS Tiger Brand** ELECTRICAL WIRE & CABLE

USS

UNITED STATES STEEL




# THOMAS makes all Five

EEI-NEMA STANDARDS show five designs of low and medium-voltage pin-type insulators. Although we catalog 22 pin-type designs, we are 100% behind any standardization that we believe helps the Industry. Therefore, we suggest that Users specify the five EEI-NEMA Standards for their low and medium voltage pin-type requirements.

Thomas insulators are backed by 82 years of ceramic experience and knowledge. Quality materials, precision manufacturing and PROOF OF PERFORMANCE make THOMAS porcelain the standard of comparison for discriminating engineers throughout the Electrical Industry.

Specify Thomas EEI-NEMA STANDARDS for your porcelain requirements. Insulators No. 1157, No. 1177 and No. 1262 are offered with the Thomas, Patented, Noise-Free, "Quiet-Type," under-glaze treatment at no extra cost. Simply specify the catalog number with the suffix "Q-T."

*The R. Thomas and Sons Co.*

**LISBON, OHIO**

1873 THOMAS INSULATORS our 82nd year RELIABILITY 1955

# High Pressure Answer Men

Increasingly high pressures and temperatures used in processes today demand the most advanced engineering and metallurgical treatment of the piping and equipment to handle them. The M. W. Kellogg Company has earned a long-standing reputation in this specialized engineering area.

Largely responsible for M. W. Kellogg's position is the company's "Committee on Materials and Fabrication" which meets regularly to discuss developments of pure and applied research as they concern service experience, metallurgical progress, welding techniques, and improved methods of fabrication.

Composed of principal engineers from M. W. Kellogg's process engineering, mechanical engineering, and construction departments, as well as the Fabricated Products Division, this Committee benefits all of the company's activities and the facilities they offer in their respective fields.

The Committee on Materials and Fabrication is one reason why The M. W. Kellogg Company is recognized as the leader in the design and fabrication of piping, pressure vessels, heat exchangers, waste heat boilers, and process equipment requiring transient and maintained pressures and temperatures.

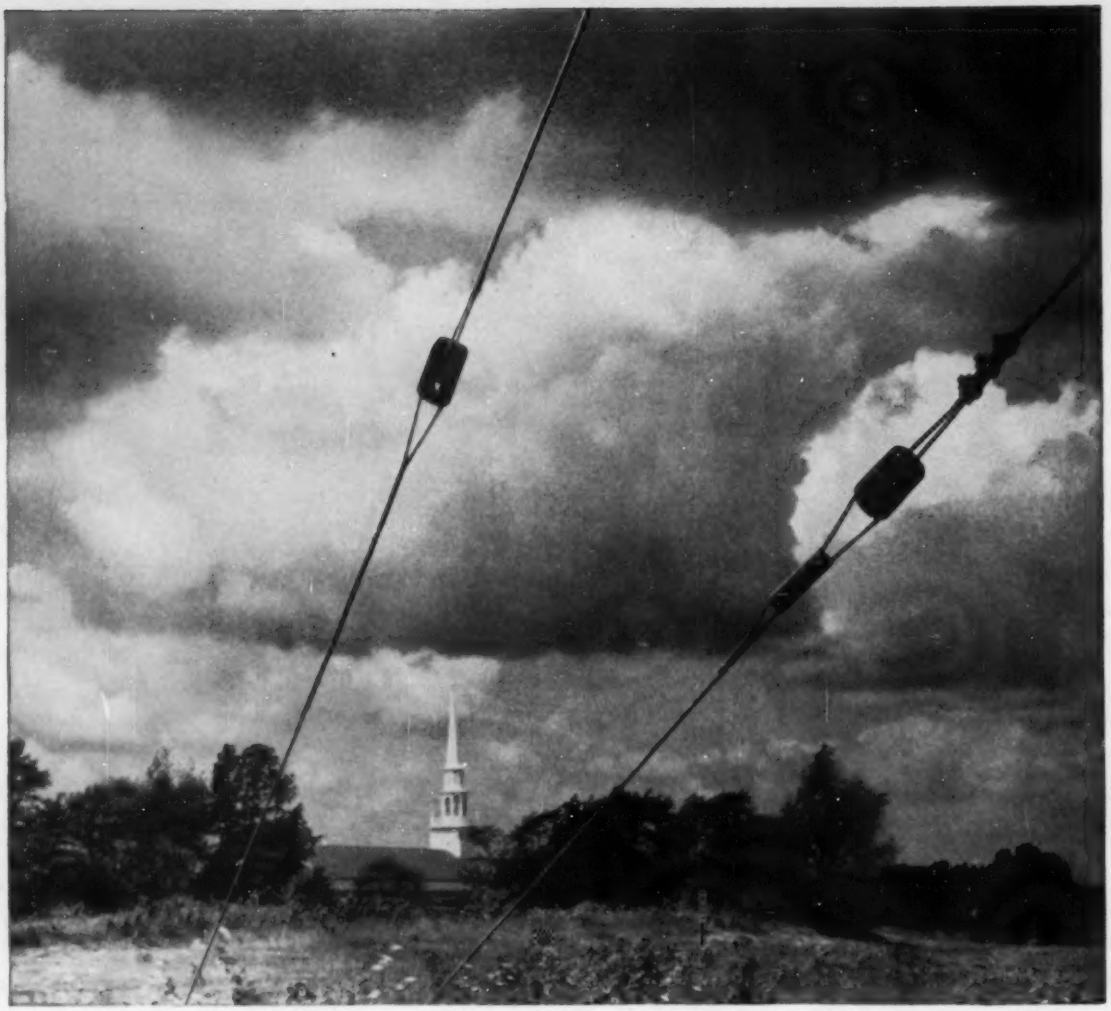
# M.W. Kellogg

**ENGINEERING FOR TOMORROW**

THE M. W. KELLOGG COMPANY, NEW YORK 7, N. Y.

The Canadian Kellogg Company, Limited, Toronto • Kellogg International Corporation, London.

SUBSIDIARIES OF PULLMAN INCORPORATED



# Guy-Grips* BY PREFORMED

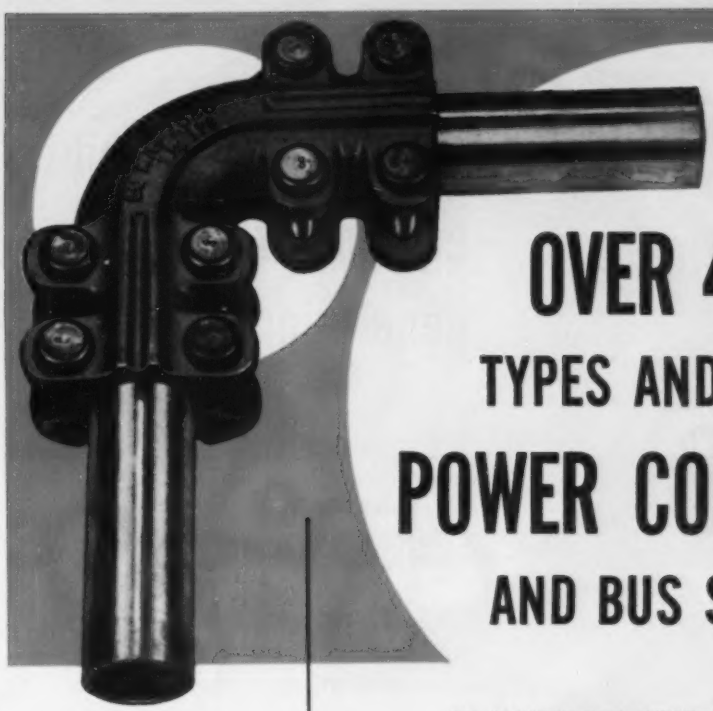
## ...Economical...Neat...Efficient

*at the left

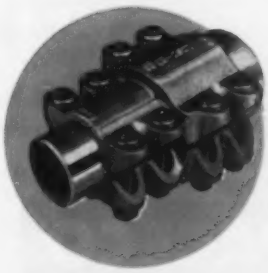
**PREFORMED LINE PRODUCTS COMPANY**

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXpress 1-3571



# OVER 4,000
## TYPES AND SIZES OF
# POWER CONNECTORS
## AND BUS SUPPORTS



### IN SOUTHERN STATES' COMPLETE LINE

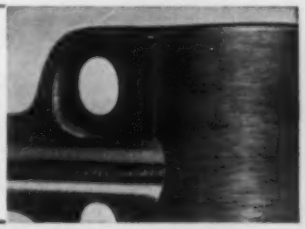
To meet the widest range of requirements for power and grounding connectors, Southern States produces more than 4,000 different types and sizes—many on special order to customers' specifications.

Widespread use of self-supporting, rigid, tubular bus constructions in substations has increased the mechanical requirements of many connectors. That is why Southern States connectors have been re-designed during the past two years. They now have stronger ears and are 40 to 50% heavier.

When you specify and use Southern States connectors, you can be sure they are capable of: 1) serving as self-supporting members; 2) providing good electrical connection; 3) developing full strength of clamping bolts without visible distortion; 4) carrying current equal to the conductor without excessive temperature rise; 5) being installed with a minimum of effort and time.

***Rough Ground for Best Possible Contact***

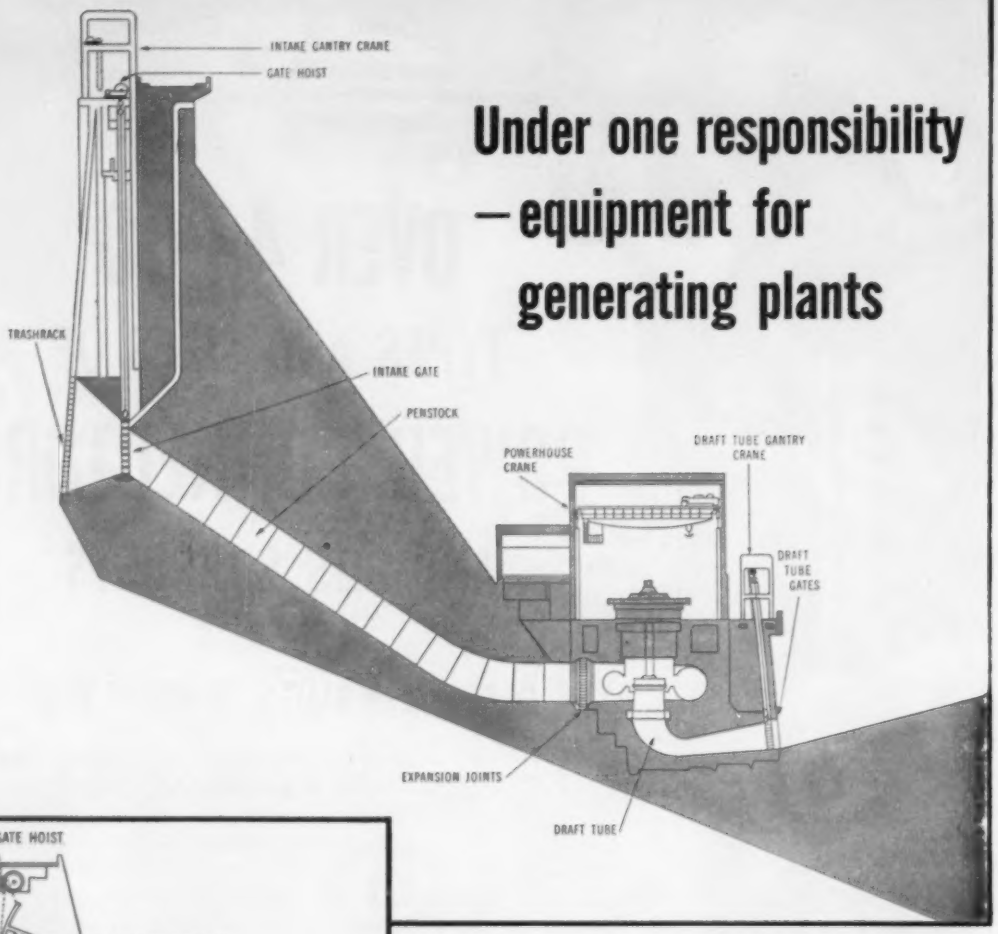
Every Southern States connector is rough ground on all contact surfaces. This permits the connector to bite into the conductor, causing intimate metal to metal engagement at thousands of high-pressure contact points, thus providing a better junction and one that is sealed against corroding atmosphere.

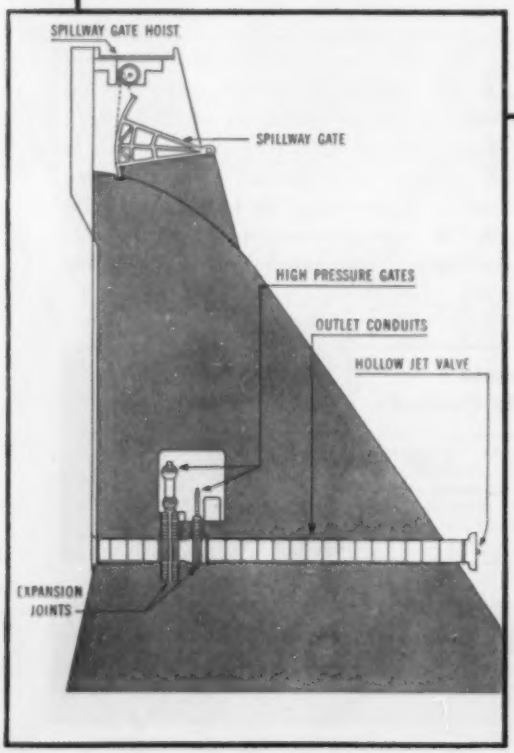


**SOUTHERN STATES EQUIPMENT CORP.**
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

# Under one responsibility —equipment for generating plants




● Under *one* responsibility, Paceco engineers, machines and fabricates many essentials for hydroelectric and steam power plants and waterworks.

You get from *one* source a cost-conscious engineering service and follow-through that eliminates divided responsibility.

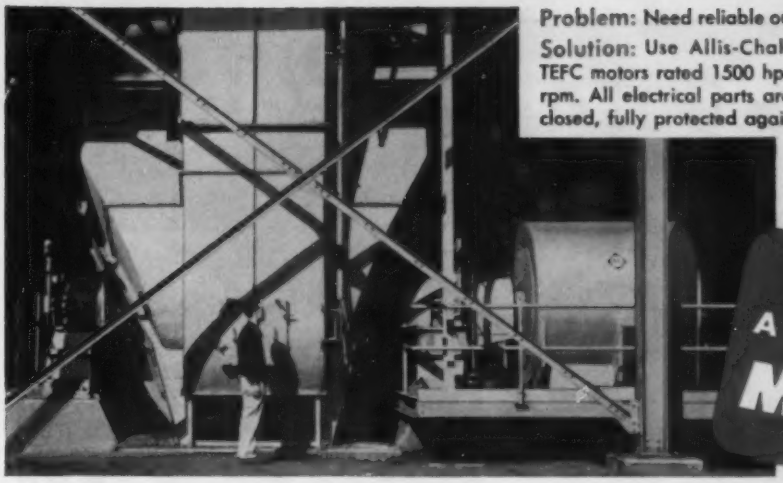
Paceco service is available nationwide, at competitive prices, delivered and installed. We invite your inquiries.

PACECO
"TAILORS OF STEEL"

## Pacific Coast Engineering Company

ENGINEERS • MACHINISTS • FABRICATORS

Alameda, Calif. • Phone LAkehurst 2-6100



**Problem:** Need reliable outdoor operation.

**Solution:** Use Allis-Chalmers tube-type TEFC motors rated 1500 hp, 4000 volts, 880 rpm. All electrical parts are completely enclosed, fully protected against weather.

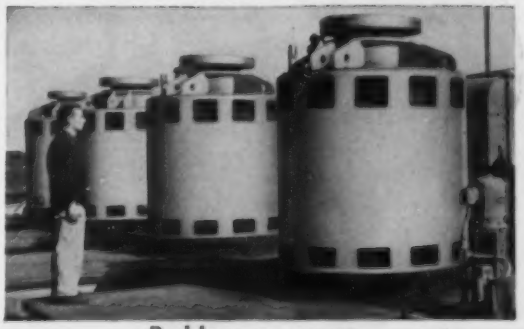
ALLIS-CHALMERS
Auxiliary-Drive
MOTORS

# 3 Problems — 3 Solutions

### Eastern Utility Gets Exactly the Right Motor for Each Job from Allis-Chalmers

Public Service Electric and Gas Company chose Allis-Chalmers motors for many of the major auxiliaries in their Kearny (N. J.) Generating Plant. The reasons: reliability and economy.

Allis-Chalmers builds a type and size for every auxiliary drive in the power plant. Whether your problem is space, fly ash or an outdoor location, there's a motor in the Allis-Chalmers line to provide the continuity of service you need. Let an Allis-Chalmers representative help you select the motors for your job. A-4582



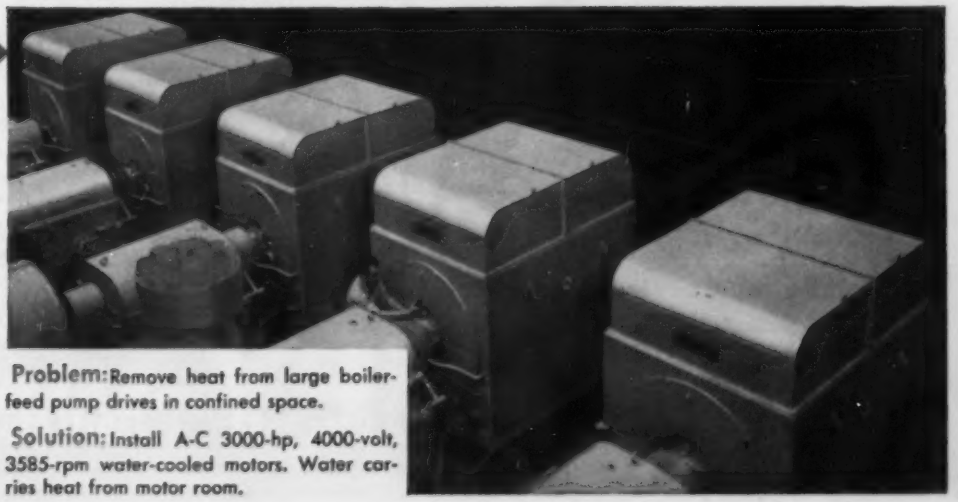
**Problem:** Keep building costs down.

**Solution:** Put pump drives outdoors, using Allis-Chalmers tube-type TEFC motors rated 350 hp, 440 volts, 400 rpm.

# ALLIS-CHALMERS

Milwaukee 1, Wisconsin

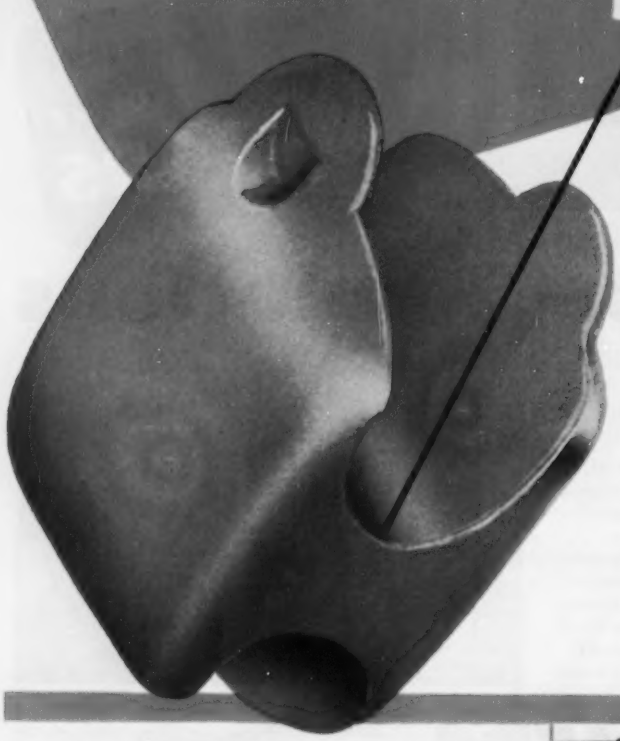
A-C ALLIS-CHALMERS



**Problem:** Remove heat from large boiler-feed pump drives in confined space.

**Solution:** Install A-C 3000-hp, 4000-volt, 3585-rpm water-cooled motors. Water carries heat from motor room.

# The Secret is in the "built-in" Spacer

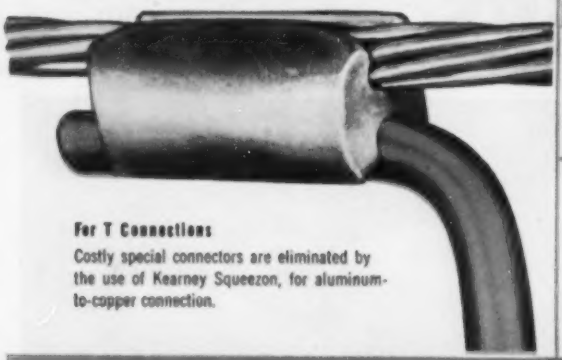


# KEARNEY SQUEEZON

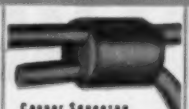
## CONNECTORS are designed for greater versatility

The exclusive Kearney design provides the "built-in" spacer. This barrier of metal between the conductors resists galvanic action and, in addition, assures greater conductivity since each conductor is "cold-welded" around its perimeter. Because the wires do not touch each other, there is less danger of flattening or pinching the strands.

**KEARNEY SQUEEZON** connectors are applied with hydraulic or mechanical tools, in less time . . . at a fraction of the cost of older types of connectors.



**For T Connections**
Costly special connectors are eliminated by the use of Kearney Squeezon, for aluminum-to-copper connection.



**Copper Squeezon**
One operation of the Squeezon compression tool permanently bonds this type of joint.

**Service Entrance Sleeves**
for high-pressure connections of secondary to meter loop.

**Dead-Ends**
One crimp per Squeezon saves time when multiple connections are used.

**Stirrup Tap**
Two Squeezons and a short piece of wire make an inexpensive, easy-to-install stirrup, insures a rigid, connection on hot lines.

**Aluminum Squeezon**
Provides large area contact — prevents cold flow; for aluminum to copper or copper to aluminum.

**Line Splice**
Line splices are better electrically and mechanically with Kearney sleeves.

For Better Construction . . . Safer Maintenance

JAMES B. KEARNEY CORPORATION ST. LOUIS 10, MO. GUELPH, ONT.

Specify **KEARNEY PRODUCTS**

*The Mark of Quality*

JAMES B. KEARNEY CORPORATION • 4124-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

Supplementary pages for the BTC Hi-Line Hardware Catalog have just come off the press. These supplements contain blueprints and complete specifications on revisions and additions to our line of Drop-Forged Steel and Aluminum Hi-Line Hardware.

Send for these free supplementary pages and bring your BTC Catalog up-to-date. If you do not already have a catalog, indicate on coupon and a complete, revised copy will be mailed to you without charge.

**THE BREWER-TITCHENER CORPORATION**
CORTLAND, N.Y.

***Pioneers in Drop-Forged Hi-Line Hardware***

*Clip & Mail Today!*

THE BREWER-TITCHENER CORPORATION
CORTLAND, N.Y.

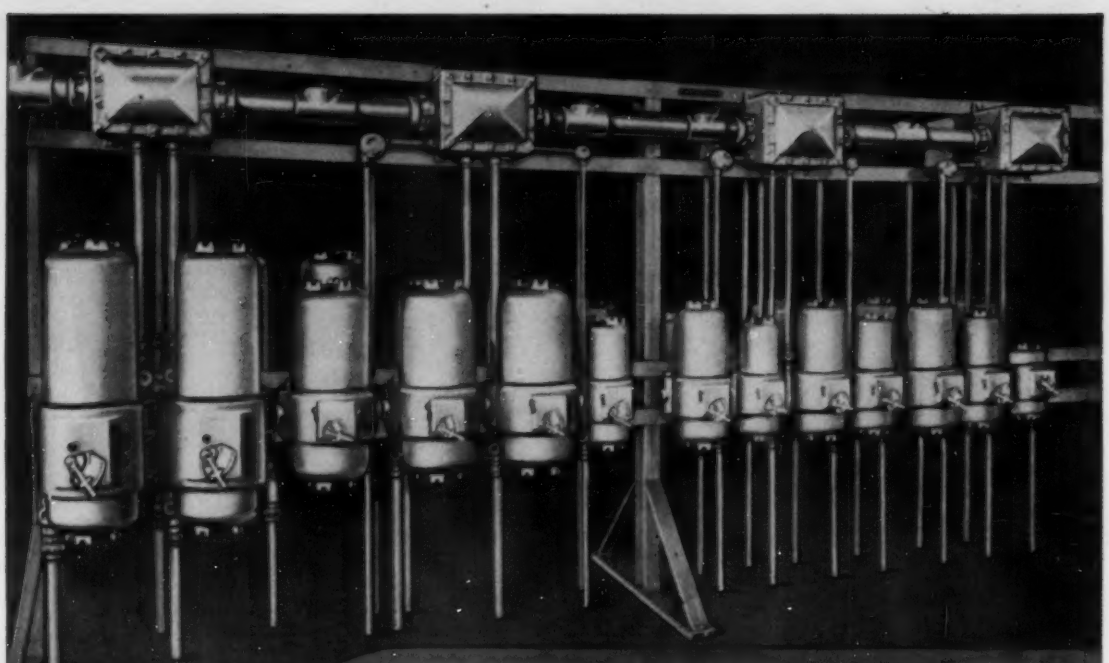
☐ Please send Supplementary Pages for BTC Catalog.
☐ Send complete, revised BTC Hi-Line Hardware Catalog.

NAME _____ TITLE _____

COMPANY _____

STREET _____

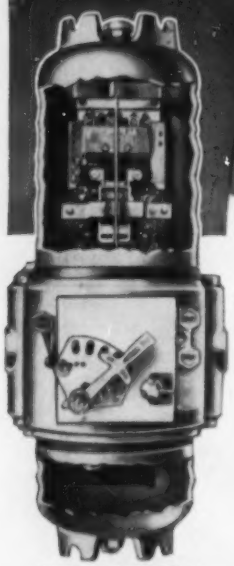
CITY _____ STATE _____



# CROUSE-HINDS Type EPC

## MOTOR STARTER and CIRCUIT BREAKER

## *Explosion-Proof* CONDULETS* are compact!



**Type EPC Combination Line Starter Condulet with Broken-Away Covers Showing Interior Starter and Circuit Breaker Assembly**

## Little space required for a big installation

Crouse-Hinds exclusive vertical cylindrical design conserves horizontal space that is always at a premium, speeds up installing and wiring, and saves money on the construction of steel mounting racks.

- **Explosion-proof, dust-tight,** and **weather-resistant** (raintight).
- **Light-weight cast aluminum** — for easy installation and maintenance. No lifting equipment required. Saves time and money.
- **Flame-tight threaded joints** throughout — the type of construction that was pioneered by Crouse-Hinds. Covers are taper-threaded with seven threads for extra safety. Operating shafts and bushings are thread-in-thread construction.
- **Seven conduit entrances** — give you the choice of either vertical or horizontal "through feed", "U" at either top or bottom, "T", or "L" at either side or back. Saves money by simplifying installation. Large central body — for easy wiring.
- **Built-in push button stations** and built-in selector switch are available.
- **Versatile.** Wide selection of well known controls. Starter sizes 0 to 5. Circuit breakers 50 to 600-Amp. frame sizes.
- The Crouse-Hinds Type EPC advantages all add up to **lower installed cost** and **lower maintenance cost.**

*CONDULETS are made only by CROUSE-HINDS

A Nationwide Distribution Through Electrical Distributors

**CROUSE-HINDS COMPANY**
**Syracuse 1, N. Y.**

OFFICES: Amarillo — Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Memphis — Milwaukee — New Orleans — New York — Philadelphia — Pittsburgh — Portland Ore. — San Francisco — Seattle — St. Louis — St. Paul — Tulsa — Washington, D.C. RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Charlotte — Chattanooga — Corpus Christi — Reading, Pa. — Richmond, Va. — Shreveport

Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

**CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS**

# Give the Guy a CHANCE

## the NEVER-CREEP pulls against undisturbed earth in machine or hand-bored holes

Circle shows reinforcing plate and rod socket.
The Never-Creep is formed of high strength structural steel, reinforced in area of greatest pull with a high carbon steel core plate.
they've been trying to pull this one out since great grandpappy's days!
MIKE THE MOLE ©

***Once in, they're in to stay!***

Pull test after pull test—made for power companies all over the country—show the same result: "Test stopped without failure. There was no damage to the anchor."

And the test of time proves that thousands of Never-Creeps installed for years and years hold more "over the long pull" than any other type of anchor.

Chance Never-Creep Anchors can be installed in holes drilled at an angle by your hole boring equipment. The size of the hole makes no difference in the holding power of the Never-Creep—it pulls entirely against solid undisturbed earth, and is practically unaffected by moisture seepage.

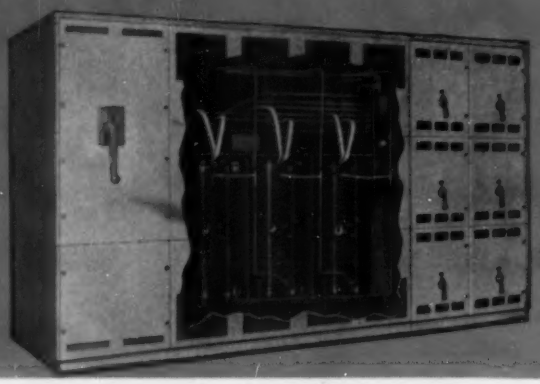
Protect your investment in line construction by specifying Chance Anchors for your guys. The Chance Distributor in your area can probably fill your order from stock. *Specify Chance for Service!*

ABC ALL INDUSTRIES

**A·B·CHANCE CO·**

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS



**DRY-TYPE**

Wagner open, ventilated dry-type transformers are suitable for indoor use only. They are normally installed in a reasonably dry, dust-free atmosphere and in a well-ventilated location. Since they are light in weight, these transformers are often used in multi-story buildings. No fireproof vaults are required when you use Wagner dry-type transformers.

**Wagner®**
**TRANSFORMERS**
**... the choice of leaders in industry**

*No matter what your load-center requirements, you can get a*

# Wagner Substation Transformer *PREDESIGNED* to meet your needs

- ✓ ***save*** **shipment time**
- ✓ ***save*** **job engineering costs**
- ✓ ***get*** **full Wagner Quality with switchgear of your choice**

Wagner "Predesigned" standard unit substation transformers are carefully engineered to meet heavy industrial demands—they are not designed for minimum duty only. Predesigning completely eliminates individual job engineering time ... reduces your costs ... and permits quick delivery.

When you specify Wagner "Predesigned" transformers you get the advantages of a proved design in a completely assembled transformer, tested at the Wagner factory. They are built in standard ratings which are coordinated with the specifications of all unit substation builders.

Wagner builds a complete line of substation transformers—open, ventilated dry-type, Oil-Filled, Noflamol, and sealed dry-type Nitrogen-Filled—in ratings from 112½ through 2000 kva, 15 kv and below, to handle practically any distribution requirements.

You can specify the Wagner Transformer that exactly meets your load-center distribution requirements—be assured of full Wagner Transformer Quality—and gain a substantial advantage in delivery time and in cost.

Investigate the many advantages of specifying Wagner "Predesigned" Unit Substation Transformers for your next load-center installation. Consult the nearest of our 32 branch offices, or write direct to us.

Wagner Electric Corporation EST. 1891

**WAGNER ELECTRIC CORPORATION**
**6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.**

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

*BRANCHES IN 32 PRINCIPAL CITIES*

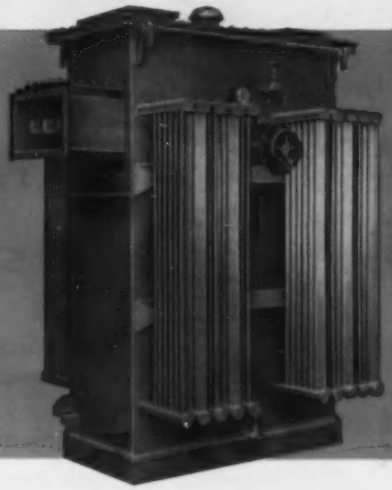
## CLOSE-COUPLED DESIGN

This is the close-coupled design which is now available along with standard throat-connected liquid-filled models. The transformer fits flush against the switchgear enclosure, eliminating the throat and saving space. Connections are made at the bushings on the sides of the transformer. The close-coupled design is available in ratings from 500 through 2000 kva.

## LIQUID-FILLED

Oil-filled transformers are generally installed outdoors, although they can be used indoors if suitable fireproof vaults are provided.

Noflamol transformers are filled with a non-inflammable synthetic liquid, and can be built for indoor or outdoor installation. Noflamol transformers are used in all types of plants, but they are especially suitable for chemical plants, refineries or other locations where explosive liquids or gases are present.

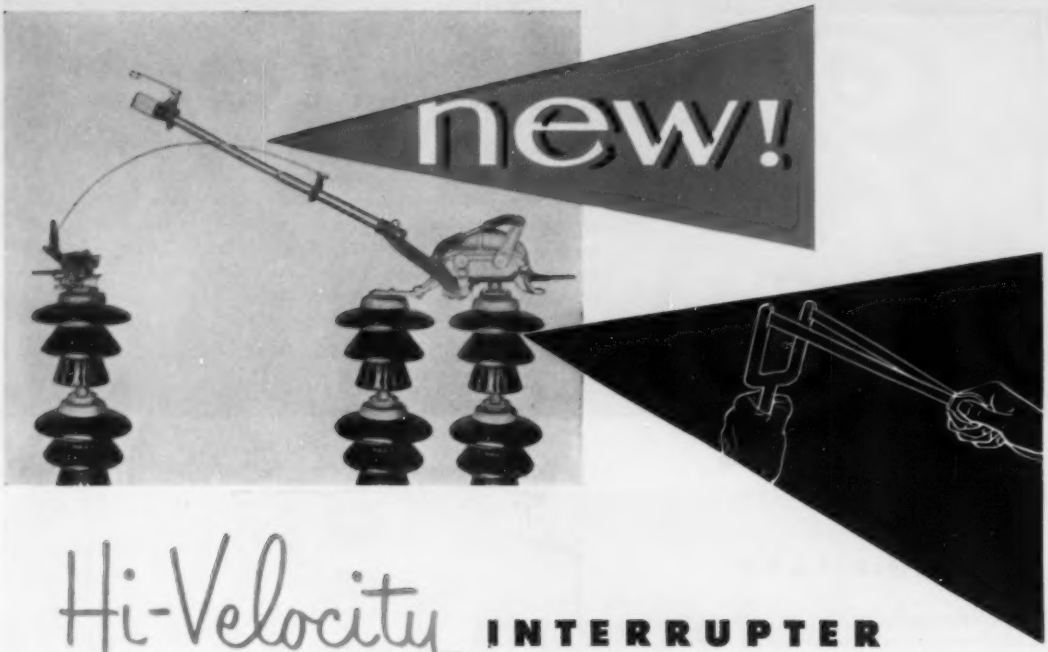


## NITROGEN-FILLED

Wagner's sealed dry-type nitrogen-filled transformers offer many advantages in maintenance and safety. They are suitable for indoor or outdoor use—covers are welded to the tanks. They require only a minimum of maintenance—they present no cleaning problems, even in dust-filled areas. They are completely fireproof. Wagner nitrogen-filled, Class H Silicone Insulated Transformers are available in ratings up to 2000 kva.

T99-8

**Write for Wagner Bulletin TU-205. It gives full information on Wagner Unit Substation Transformers for industrial power distribution systems.**




# Hi-Velocity INTERRUPTER

## snaps open with sling-shot speed

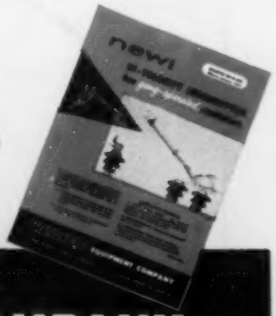
■ For gang-operated switches, this new Hi-Voltage, Hi-Velocity Interrupter assures an economical and dependable way to:

1 Switch capacitive currents

2 Interrupt transformer magnetizing currents

A few of its distinctive features are: (1) only three parts; (2) non-corrosive; (3) tremendous "sling-shot" action; (4) exclusive damping action; (5) strong, sturdy and durable; (6) independent operation and (7) positive electrical contact.

■ **Ask your Joslyn Representative to tell you more about this new Hi-Velocity Interrupter or write to us for Descriptive Bulletin HV 10-200.**




**HI-VOLTAGE EQUIPMENT COMPANY**

DIVISION OF JOSLYN MFG. & SUPPLY CO.

4000 EAST 116th STREET • CLEVELAND 5, OHIO

# *Noble experiment at Noblesville pays off*

## NONPAREIL *Turbine Oil*

Back in 1950 when the Public Service Company of Indiana picked a lubricant for their two new turbines at Noblesville Generating Station, they chose Standard's NONPAREIL Turbine Oil. The initial fills were 2,750 gallons for each unit. First unit started up September 11, second unit, December 17.

The guarantee that NONPAREIL will last the life of the turbines made the selection an easy one. If Standard Oil makes such a guarantee for its product, Public Service Company executives agreed, it must be the very best obtainable. Their decision was backed up by reports from an independent testing laboratory which researched four turbine lubricants for the utility.

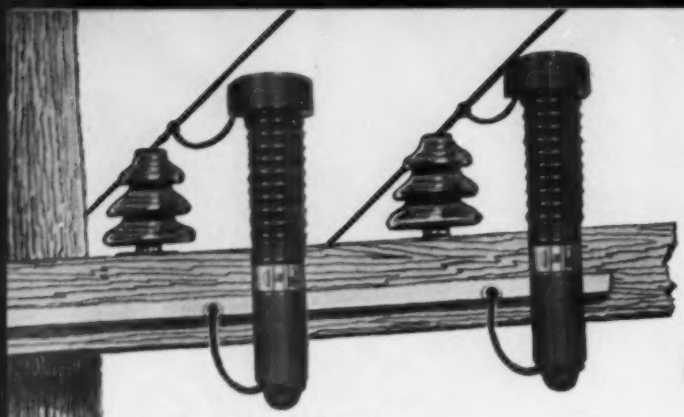
In more than four years since the initial fill, these two 40,000 kw. turbines have operated with no lubrication problems. Systems remain clean. Neutralization number is always well below 0.15 mg. KOH/g. Standard industrial lubrication specialists regularly check oil acidity. Neutralization number is more often on the order of 0.03 mg. KOH/g, they find.

Would you like to know more about NONPAREIL Turbine Oil? In the Midwest call your nearest Standard Oil lubrication specialist. Or, write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

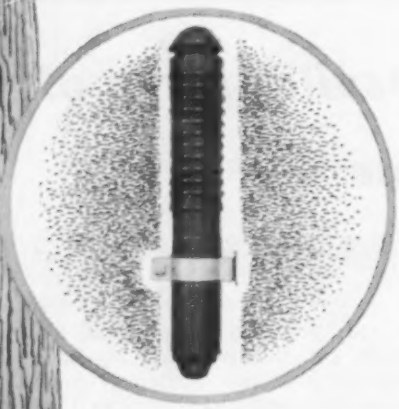
**Fred Nicoson (left), Noblesville generating station plant superintendent, with Standard lubrication specialist John Pirtle inspect bearing and turbine oil temperature charts in Noblesville station. John likes this sort of work, has been doing it for Standard Oil since he completed the special course in industrial lubrication at Standard's Sales Engineering School. John's degree in engineering from Rose Polytechnic Institute qualified him for work in the field of industrial lubrication. His customers find this background and training pay off *for them.***

STANDARD

**STANDARD OIL COMPANY**
(Indiana)



Crystal Valve All-Porcelain Sealed (Non-ventilated) Spark Gap Arrester for Cross-arm Mounting. Line-lead Ground-stud Terminals. Maximum permissible line-to-ground voltages, 3,000 to 18,000.



Crystal Valve All-Porcelain Ventilated Spark Gap Arrester for Cross-arm Mounting. Line-stud Ground-stud Terminals. Maximum permissible line-to-ground voltages, 3,000 to 18,000.

WRITE FOR helpful data folder "Proved Protection," giving all the inside facts you should consider in selecting lightning arresters.

# YOU HAVE A CRYSTAL VALVE

## 1 CROSS-ARM MOUNTING

### *FOR CV SEALED OR VENTILATED ARRESTERS*

**Choice of mounting is only one advantage of Crystal Valve Lightning Arresters. Most important advantages to distribution engineers are greatly reduced operating and maintenance costs . . . increased efficiency of the entire distribution system . . . negligible outages during lightning season.**

**If you use the conventional arrester mounting for distribution transformers, you have two types of Crystal Valve Arresters from which to choose—Sealed (Non-ventilated) and Ventilated Gap Arresters. Both have true valve action in conjunction with high-speed spark gap assembly to interrupt follow current, prevent hazards and fire risk.**

**CV Ventilated Gap Arresters are protected from corrosion by vents which permit the movement of air, prevent accumulation of moisture in housing. Amazing performance of this arrester under all service conditions proves better than 99% protection.**

**CV Sealed Type Arresters have the same high-speed multiple spark gap units, the same oxidized Silicon Carbide valve element as the Ventilated Gap Arresters.**

**Many distribution engineers prefer tank-mounting of Crystal Valve Arresters because of its simplicity, space conservation, efficiency and economy of installation.**

**Thousands of CV Arresters are giving permanent protection to "power packages" under all types of weather conditions. Many of the leading transformer manufacturers furnish their product with CV Arresters. They know Crystal Valves give unlimited surge capacity at all ratings and can be installed on all types of circuits without regard to system capacity. The four CV-equipped transformers shown here have positive protection against lightning damage, power surges, and harmful over voltage.**

# CRYSTAL VALVE
## LIGHTNING ARRESTERS

# 2-WAY CHOICE WITH JOB-ENGINEERED ARRESTERS

## 2 TRANSFORMER MOUNTING

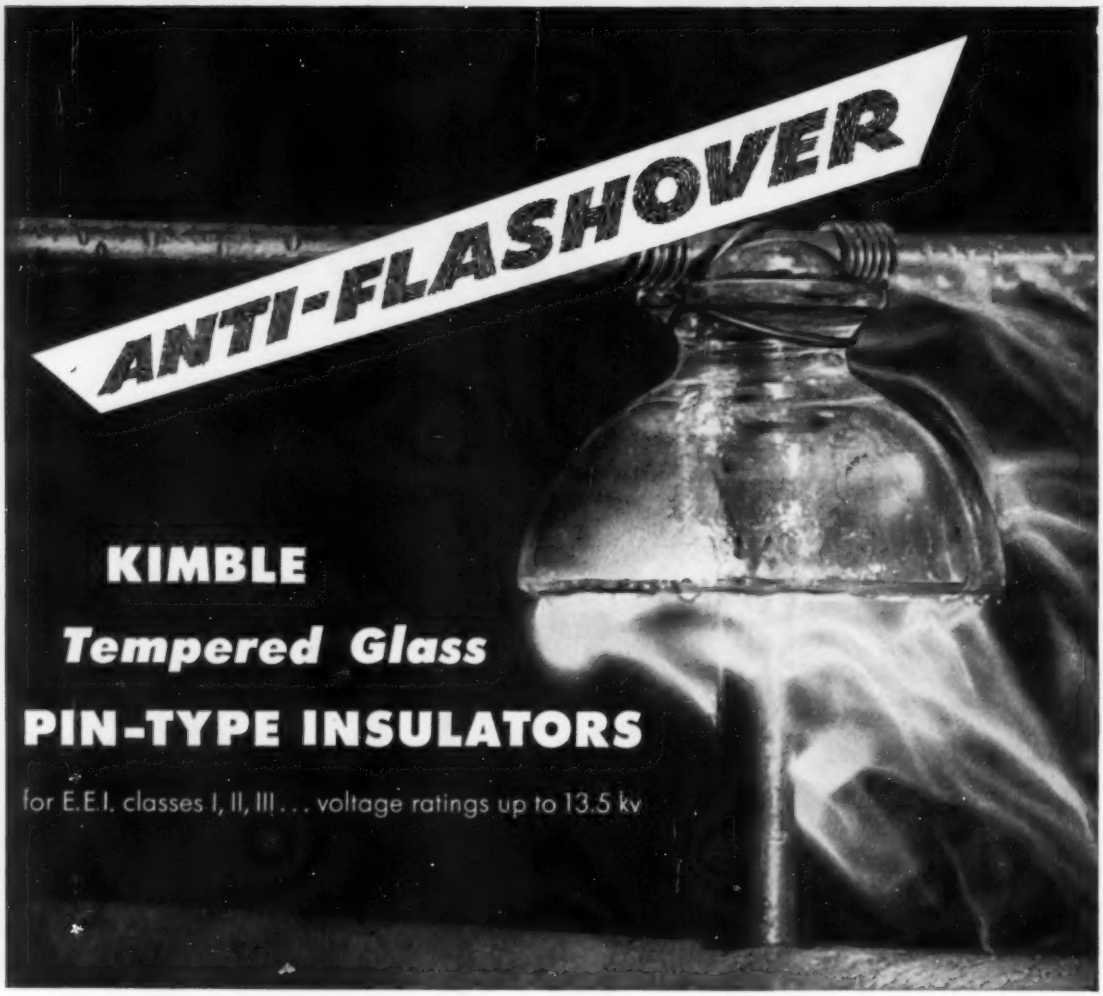
***FOR CV PORCELAIN SEALED OR VENTILATED ARRESTERS***

37½ KVA Allis-Chalmers Protected Type CP-1, Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 13,200 GrdY/7620; low voltage, 120/240 volts.
37½ KVA Pennsylvania "Protected Pole Star" Transformer with 9 KV Crystal Valve Arrester. Furnished in sizes 3 KVA through 100 KVA, up to 14,400 volts.
10 KVA Kuhlman CSP Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 7200/12,470Y; low voltage, 120/240 volts.
5 KVA Moloney HiperCore Type CSP 8-1 Single-phase, 60-cycle Transformer with 3 KV Crystal Valve Arrester.
A-C
37
37
10

# Electric Service Manufacturing Co.

PHILADELPHIA 32, PENNSYLVANIA

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto




# EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

**If it's on the pin, it's in service**

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

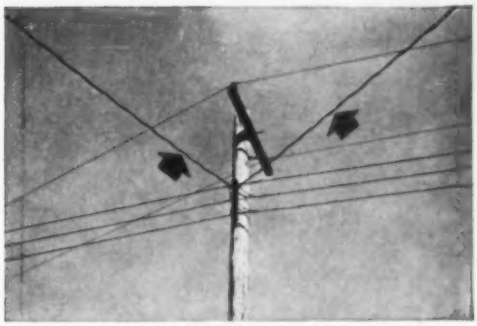
Why not see how *tempered* glass can cut your line maintenance costs. Write for folder. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-2, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

# Rugged neoprene covering

## adds extra service life to triplex cable



Years of sunlight and weathering won't crack or deteriorate sturdy neoprene covering.

With tough neoprene covering, residential installations are neat and clean-looking. No braids to rot or festoon.

Triplex self-supporting secondary and service drop cable with neoprene covering provides outstanding durability and protection. In residential areas the neoprene cover resists sunlight and weathering. There are no braids to rot or festoon. In industrial sections, neoprene protects against corroding smoke, fumes, and gases . . . gives years of dependable service.

Triplex cable is just one of the many uses of neoprene-covered cable. Wherever you use cable . . . above ground . . . in ducts . . . or directly in earth—it pays to specify cable covering of Du Pont neoprene. It's available in single- or multiple-conductor types and in voltage ratings to meet your requirements. For further information, consult your supplier.

**FREE! The Neoprene Notebook**

Each issue contains interesting applications of neoprene . . . new products . . . on-the-job reports. Send in the coupon below to get on the mailing list.

**NEOPRENE**

*The rubber made by Du Pont since 1932*

DUPONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Rubber Chemicals Division EW-2, Wilmington 98, Del.
Please put me on the mailing list for the Neoprene Notebook.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

Part of a set of 16 field coils recently completed by National for a 25,000 KVA waterwheel generator. Note the complete pole assembly ready for mounting on the rotor.

# New or rebuilt field coils by National mean *better than new* performance

Salient pole field coils deteriorate in time and require rebuilding or replacing. They are subject to copper growth, lead breakage, shorts between turns, looseness on poles, collar breakage, breaking apart of turns, and grounding to pole pieces.

Corrective measures include the use of silver bearing copper, flexible leads, Class 'B' turn and pole piece insulation, and asbestos bakelite collars and staggered turns for better heat dissipation and longer life.

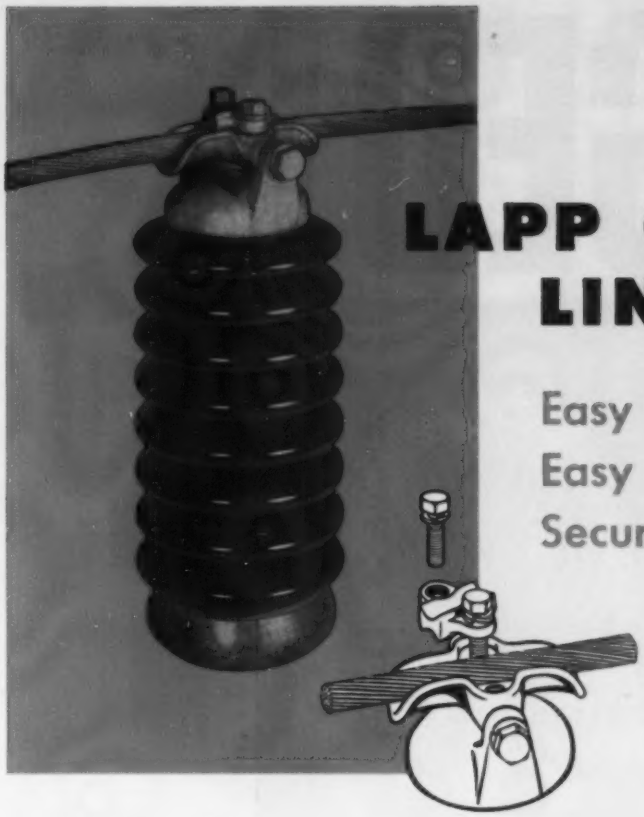
Trained personnel and heavy specialized equipment are at your command to expeditiously repair, rebuild or replace large fields; road service men are available to remove and reinstall the pole piece and coil assemblies on the rotor and to dynamically balance.

Write, wire, or call National, or get in touch with your nearby National field engineer.

## NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

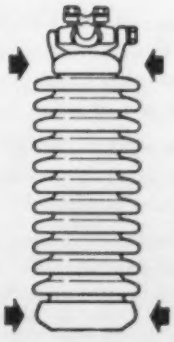


# LAPP CLAMP-TOP LINE POST

## Easy to install...
## Easy to change...
## Secure in operation

For original installation, the Lapp Clamp-Top Line Post, with clamp attached, is mounted (stud bolts of any length are interchangeable). Keeper cap screws are loosened, and one removed. Keeper is rotated out of position, conductor dropped in, keeper and cap screw replaced, and both screws tightened. Cap screws have captive washers—there's *only one loose part* per insulator throughout installation.

To change out an insulator, the trunnion screw is backed off (not removed). Clamp stays on the conductor and is slipped back into position in new insulator. All clamps are interchangeable in all sizes of Lapp Clamp-Top Line Posts. Line can be reinsulated for higher voltage with ordinary hot line tools with greatest convenience.



All Lapp Post insulators are built with hardware *externally* attached. Cracking is prevented because thermal movement or mechanical strains can load porcelain only in compression. This provides an extra margin of operating security, assures long insulator life and low line upkeep.

Lapp Insulator Co., Inc., Le Roy, N. Y.

**Lapp**

# RUGGED!

## Chase® Antimonial Admiralty resists dezincification—adds years to condenser tube life!

Chase Antimonial Admiralty Condenser Tubes contain the *right* amount of antimony needed to resist dezincification and other forms of corrosion. That's why *Chase* tubes last so much longer!

And antimony will *not* weaken the tube in other ways! That's why *Chase* tubes *stay* sound through years of adverse conditions in the field!

When you replace Condenser Tubes, or plan a new installation, get the benefit of *extra* years of service. Insist on Chase Antimonial Admiralty.

Learn more about corrosion problems, and how Chase can help solve them. Send for free Chase Condenser and Heat Exchanger Tube Booklet.

Chase®

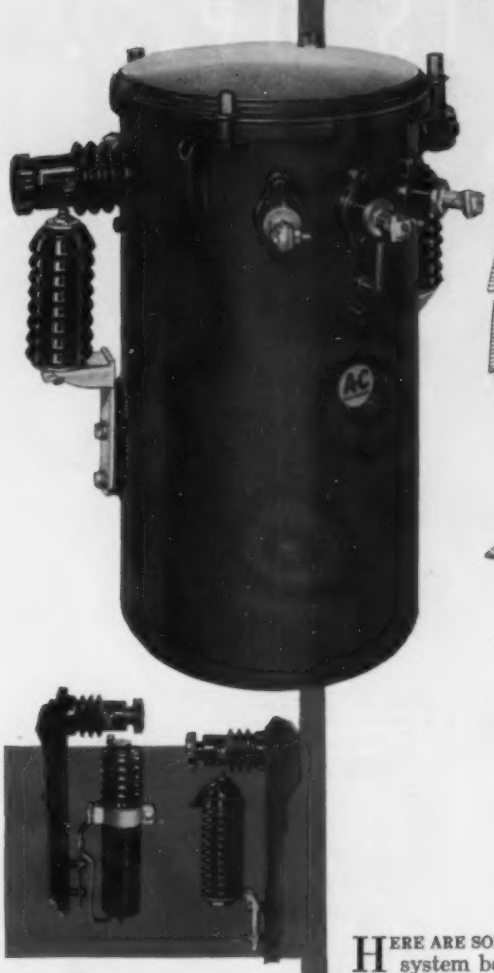
**BRASS & COPPER CO.**

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

*The Nation's Headquarters for Brass & Copper*

| | | | | | |
|---|---|---|---|---|---|
| Albany† | Chicago | Detroit | Los Angeles | New York | St. Louis |
| Atlanta | Cincinnati | Grand Rapids† | Milwaukee | Philadelphia | San Francisco |
| Baltimore | Cleveland | Houston | Minneapolis | Pittsburgh | Seattle |
| Boston | Dallas | Indianapolis | Newark | Providence | Waterbury |
| Charlotte† | Denver | Kansas City, Mo. | New Orleans | Rochester† | (†sales office only) |

# ACP Transformers



- **Simpler Installation**
- **Less Maintenance Cost**
- **More Transformer Capacity**

## Allis-Chalmers lets you choose your lightning arrester

Either valve-type or expulsion lightning arresters are available on ACP transformers. You may select the exact arrester you prefer. An air gap between arrester and bushing assures that arrester is never energized except during lightning discharge. The result is reduced possibility of radio interference and longer arrester life.

HERE ARE SOME OF THE WAYS your system benefits when you use Allis-Chalmers *Protected* transformers: Maintenance costs decrease because many fuse-replacing trips are eliminated — circuit breakers now do the job. And you get more capacity from each transformer because premium protection lets you work closer to the maximum capacity. A convenient signal gives plenty of warning when overload conditions exist.

### Complete Package

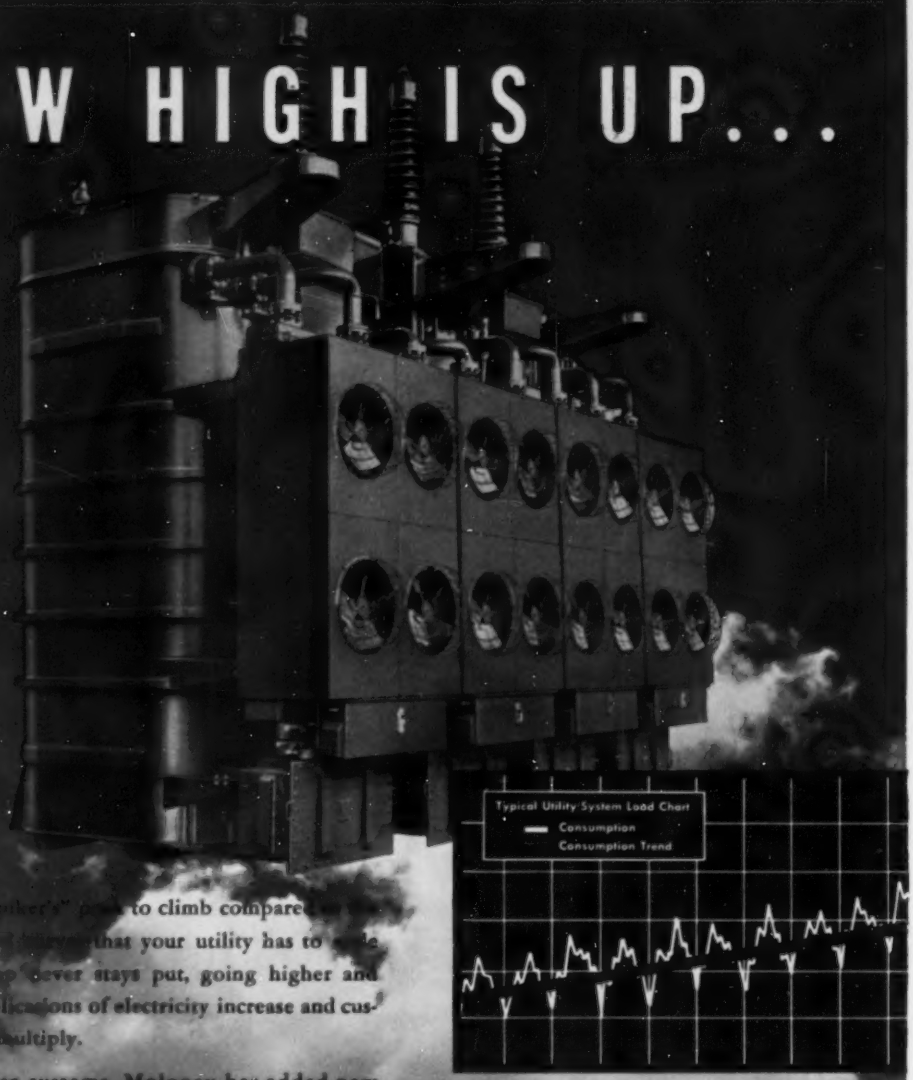
Best of all, this premium protection comes in a single, easy-to-handle package. Lightning arresters, gaps, low voltage circuit breakers, and protective links are built in. Installation is simpler than with a conventional distribution transformer. There are no extra accessories, nothing else to buy.

There are advantages in extended transformer life, too. Find out all about how ACP transformers pay off in better system operation, lower overall costs. Consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 61B7309B. A-4545

ACP is an Allis-Chalmers trademark.

**ALLIS-CHALMERS**

# HOW HIGH IS UP...




Utility demand charts show that more and more electricity is being used around the clock and around the calendar.

[illegible] is a "piker's" game to climb compared to the [illegible] demand figures that your utility has to [illegible] daily. The top never stays put, going higher and higher as applications of electricity increase and customer needs multiply.

To serve these systems, Moloney has added new facilities to design and fabricate power transformers of greater Kva ratings to meet your present and future needs.

Moloney can give your system the dependability that operating efficiency requires. Make it Moloney, the "Sign of Quality" all along the line.

**MOLONEY ELECTRIC COMPANY**

*Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers • Load Center Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics*

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

## EDITORIALS

# Give the Engineers the Credit They Deserve

This week is National Engineering Week. Electric utilities everywhere have reason to pay tribute to the men who conceived, planned, and built the systems which bring light and power to the nation's homes and industries. It was these utility engineers who have played a key role in bringing us the highest standard of living in the world today.

Electric utilities would do well to set some time aside this week to ponder the means of maintaining the high standards of engineering required by this ever-growing and vital industry. This means holding together present engineering staffs and attracting first rate young engineers to the industry. It involves guiding the engineering student toward the power industry.

Probably no single topic drew more discussion at the Winter General Meeting of the American Institute of Electrical Engineers than the problem of bringing young engineers into the utility field. The problem wasn't on the program, but it crept into a number of technical sessions and was popular in the "corridor sessions."

In seeking the services of the young engineer, the electric utilities are in a highly competitive field. And to the competitors of the past, electronics, communications, manufacturing, etc, has been added nuclear power. The problem boils down to two questions: **1.** For what is the young electrical engineer or engineering student looking? **2.** What do electric utilities have to offer?

Several professors attending the AIEE meeting ventured a partial answer. They indicated that the engineering graduate is looking for something more than an adequate salary. He is looking for something even beyond financial security for himself and family. His teachers believe that he is looking for a position where he can make a real contribution to his community and his country. And, like most other persons, he seeks the recognition and appreciation commensurate with his contribution.

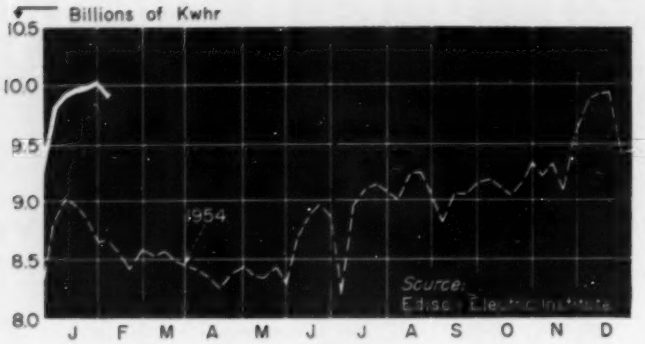
Electric utility management can understand this view because it has much in common with their own corporate objectives. And certainly utilities hold numerous opportunities for the engineer to make his contribution to the public welfare and the community service. By its very nature the industry must operate in and for the public interest. It performs its duties best where it merits the respect and appreciation of the communities it serves.

But in seeking their objectives, both the engineers and the utilities have notable handicaps in gaining the credit and appreciation they merit. The engineer in his work uses a language of his own, one not easily understood by the layman. Neither the engineer nor the utilities have much direct contact with the individual customer. The customers, who usually have no understanding of utility operation, cannot be expected to show much appreciation.

Some electric utilities have made notable progress in carrying their operations story to their customers. Through this story they can also create public understanding of the engineer's role and his contributions. A conscious effort to tell of the engineer's part in public service could pay off for utility companies.

# THE ELECTRICAL WEEK






## OUTPUT

**Week Ended Feb. 12**

**9,922,000,000 Kwhr**

**Up 14.3%**

Per Cent Change from Previous Year

| | Total US | New Eng. | Mid. Atlan. | Cent. Ind. | West Cent. | South-east | South Cent. | Rocky Mount. | Pacific NW | Pacific SW |
|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 12 | +14.3 | +5.4 | +6.8 | +15.4 | +8.4 | +25.7 | +12.0 | +12.4 | +8.9 | +9.3 |
| Feb. 5 | +15.8 | +9.3 | +9.0 | +15.3 | +9.2 | +27.5 | +12.0 | +12.0 | +10.8 | +15.6 |
| Jan. 29 | +13.0 | +5.1 | +5.8 | +12.5 | +5.2 | +28.6 | +7.2 | +9.3 | +5.3 | +9.1 |

Seasonally Adjusted Index 183.6 Week Ago 184.1 Year Ago 160.2

**The Issue's Highlights**—Con Edison's Searing outlined before the Joint Atomic Energy Committee the utility's plan to build a nuclear power plant of about 200,000 kw near Peekskill, N. Y., with private funds . . . AEC Chairman Lewis Strauss' apparent Dixon-Yates victory might have placed him on a political "hot spot" . . . President Eisenhower's "Buy American" policy faces major test when the Administration acts on English Electric's low bid for six generators for Chief Joseph Dam.

**Contract** has been let for world's largest transformer—a 360,000-kva unit for Detroit Edison's biggest generating unit. Second and third largest are 315,000-kva transformers ordered for the Rouge Plant.

**Production** has been resumed at Aluminum Co of Canada's smelter at Kitimat in northern British Columbia, following restoration of power which failed when main transmission lines were severed in a Kildala Pass snowslide (EW, Feb. 14, p 8). Company spokesmen still would not comment upon actual loss in production other than to state power stoppage would "reduce Alcan's 1955 production by less than one-half of one per cent." For design and construction of line, see p 108.

**Georgia's** House State of Republic Committee approves proposal to investigate rates of Georgia P&L. Rep R. E. Wheeler, who introduced bill, called company's rates prohibitive and said they were a bar to industry coming to South Georgia . . . Four months of hearings on a request by Potomac Electric Power for a $5,785,000 annual rate boost ended last week. Pepco was given until Feb. 23 to file a final brief. Only one witness testified against the rate hike.

**Oklahoma** State Sen George Miskovsky said Oklahoma will invite a group of private electric companies to select an Oklahoma site for a proposed $50 million atomic power plant. He revealed idea was suggested by Sen Ray Fine, senate president pro tempore. Gov Raymond Gary has already favored the idea, Miskovsky said. He declared he will extend the invitation when he determines whom to contact.

**Madison, Ind., City Council** has agreed to annex site of Indiana Kentucky Electric Corp's $175 million Clifty Creek power plant property. Asked if IKEC will file litigation against annexation, company's attorney Paul R. Schnaitter said: "If City Council has determined to annex plant, there is no other method of resisting other than litigation. No choice is left."

## NEWS OF THE INDUSTRY BRIEFLY TOLD

**Post another entry** in the atomic power field. North American Aviation's experimental sodium-graphite reactor is being wired for electricity. Southern California Edison will furnish the turbogenerator portion of plant and has already called for bids for a 7,500-kw unit.

**British government** will spend $840 million to build 12 atomic power stations in next ten years, a White Paper reveals. Minister of Fuel and Power Geoffrey Lloyd said Britain may be building no new generating capacity other than nuclear within the next decade.

**NRECA convention highlights from Atlantic City . . .** Charging that Administration "gave away atomic energy that you taxpayers spent $2 billion to create," Sen William Langer told the convention last week that President Eisenhower would go down as "biggest giveaway president in history." Langer's freewheeling speech covered all his favorite hatreds from private companies ["I don't like private utility companies"] to Dixon-Yates contract ["I think it stinks."].

Sen Richard Neuberger said government's "partnership" policy was one in which government "relinquishes to private monopolies the powerhouses at federal dams." He also attacked "betrayal at Hells Canyon."

NRECA Executive Manager Clyde Ellis called for more government appropriations for TVA steam plants for multipurpose projects at Hells Canyon, Niagara Falls, and on Colorado and Arkansas Rivers.

REA Administrator Ancher Nelsen urged more interconnections between co-ops and private companies to "give better power rate to farmers." He added REA was watching atomic power developments closely but "prospects are not bright for obtaining power cost reductions in near future through use of atomic energy."

Arthur V. Peterson of American Machine & Foundry saw sufficient improvements in five to ten years to permit production of economical atomic power and said "It appears that atomic power will have its first economic applications" in rural systems.

## ABOUT PEOPLE IN THE INDUSTRY

Speaking on "The Profession of Management," A. J. Paull, CEICo, at a dinner given by Cleveland Engineering Society honoring General Electric Co, said: "Average successful executive-administrator is usually not most highly intelligent member of his organization. Neither is he usually best public speaker. It's a combination of many assets that makes him what he is . . . As managers, it is our duty to seek out employees with managerial skill, inspire them to come into management . . . once they are inspired, do all we can to train and develop them."

**Floyd B. Odlum,** president of Atlas Corp, told the National Western Mining Conference in Denver: "It is my opinion that by 1965 central power stations in U. S. having a generating capacity of not less than 4 million kw will be in operation fueled with uranium, that new plants fueled with uranium will be installed thereafter on a cumulative ascending scale so that by 1975 plants having at least 40 million kw of installed generating capacity will be operating with uranium as fuel."

**More News About People page 182**

H. R. Searing of Con Edison outlines for Joint Atomic Energy Committee his company's plans for . . .

# Nuclear Power for Commercial Use

Consolidated Edison Co of New York has laid before Congress its plans to build a nuclear power plant of about 200,000-kw on the Hudson River near Peekskill, N. Y., entirely with private funds.

The New York utility plans to apply to the Atomic Energy Commission for a license by April 1. It stands a good chance of getting the first industrial license to be granted for a nuclear power plant under the recently revised Atomic Energy Act.

The company's president, H. R. Searing, told the Joint Atomic Energy Committee Con Edison has received proposals on the plant from three companies — General Electric Co, Westinghouse Electric Corp, and Babcock & Wilcox Co. Of these, said Searing, the B&W offer seems the "most attractive."

He told the committee that the B&W proposal for a huge converter reactor is attractive to Con Edison because it combines a "demonstrated and conservative technique, with a substantial advance in the fuel element . . ." It also has "certain advantages from the safety standpoint," he said.

First definite knowledge that Con Edison was planning to build a nuclear power plant with its own money came last month when the utility asked several manufacturing firms to bid on a reactor of about 100,000 to 200,000 kw (EW, Jan. 10, p 53.)

The hearings before the Joint Committee are to determine what has been done under the 1954 revision of the Atomic Energy Act. Searing received warm praise from both Republican and Democratic members for the forthright way Con Edison is going about getting into the field of nuclear generation.

Searing said Con Edison went into its talks with manufacturers with two fundamental principles in mind:

**1.** To consider a reactor in the same manner as any other addition to the company's system—to order a finished product from a usual supplier at a firm price; and

**2.** To finance the plant with company money and not seek government aid.

## Consolidated Edison Shows Faith, Hope, and Charity

**(An Editorial)**

**Announcement by Consolidated Edison Co of New York that it will build a 200,000-kw nuclear power plant was acknowledged by the newspapers and the public as "big" news. It should be "big" news for the industry also but for reasons that neither the newspapers nor the public are likely to understand**

**In taking this forward step, the management of the company is fully aware of the many headaches involved. They know that in building such a plant without any financial help from the government (the first company to do so), they are taking one of the greatest financial risks since Edison built the company's Pearl Street Station. They know that they can build a conventional station and get energy for less cost. They know that in pioneering a nuclear plant, they will have to overcome countless engineering obstacles.**

**But Consolidated Edison management will persevere in their plans. They have faith in the future of nuclear power plants. They hope that by getting into nuclear power at this early stage, their engineers will gain considerable practice and knowledge which will pay off later. They believe that the promotion and progress of nuclear power plants are the responsibilities of private enterprise. As one of the largest of all investor-owned electric companies, Consolidated Edison, they believe, should contribute handsomely.**

**For their faith, hope, and charity, Consolidated Edison management deserves the commendations not only of the editors of this magazine but of the entire industry as well.**

"In other words, our chief objective has been to get something done, for we firmly believe that only by actual construction of projects can the art be placed on a commercial basis," Searing said.

The company doesn't think it can get started on construction in less than a year. And Searing estimates initial generation will not be possible in less than four years.

## No Fuel Worries

Con Edison is not worried about either availability of fuel or fuel and liability costs. Searing said Con Edison approached the fuel cost problem by noting that costs of conventional fuels in the New York area are relatively high, so that anticipated nuclear fuel charges would not enter into evaluating the economics of the reactor as a power producer. In other words, the reactor would have to be an economic producer of power regardless of the fuel.

Since Con Edison has a large system, it can assume substantial risks, Searing said. This, coupled with the fact that B&W's proposed reactor has safety advantages, and that insurance companies would have had time to look into the matter of liability by the time the plant was ready to operate, persuaded Con Edison to go ahead without worrying much about the liability problem. Futhermore, Searing said, the company feels the insurance problem will be solved shortly because "they'd better take on some of the risk if they want to stay in business."

Searing estimated cost of the new plant at $30 to $40 million. If the plant produces a full 200,000 kw, this would put the per-kilowatt cost at $150 to $200—not much more than a conventional generating plant.

During last week's hearings, Dr C. G. Suits, General Electric vice president and director of research, and Dr William A. Steiger, manager of Westinghouse's patents department, testified for the National Association of Manufacturers.

Dr Suits, who is also chairman of NAM's atomic energy research subcommittee, pointed out:

- The guaranteed fair price for plutonium produced from licensed private plants should be extended from seven to ten years, and should take effect from the start of production, not from issuance of license.
- Complete "Q" clearance should be available to qualified and reputable industrial firms without the necessity of undertaking an AEC contract.

Dr Steiger, NAM atomic energy patents subcommittee chairman, said:

- Compulsory licensing of patents, as embodied in the new law, is "not in accordance with the spirit of the Constitution," works a particular hardship on the small or specialty manufacturer, and is not in the interest of advancing the art.
- Section 155 should be repealed. This provides that "the fact that the invention or discovery was known or used before shall be a bar to the patenting of such invention or discovery even though such prior knowledge or use was under secrecy within the atomic energy program of the United States."

The Joint Committee does not plan to renew its hearings until the end of the month. At that time, it will continue to hear public witnesses until no more requests to appear have been received.

At about the same time, AEC will meet with seventeen private and public utility officials to discuss its proposed regulations under the new act. When their views have been received, the proposed regulations will be published in the Federal Register for public comment.

STRAUSS stacks up evidence for committee that power issue is not hampering AEC as . . .

# Victory Is Near for Dixon-Yates

Atomic Energy Commission Chairman Lewis Strauss apparently has won his fight over the Dixon-Yates contract—but it might put him on the spot politically.

The Dixon-Yates partnership, composed of Middle South Utilities, Inc, and Southern Co, has won Securities and Exchange Commission approval for equity financing for the West Memphis, Ark., power plant and is expected to have little trouble in getting SEC to okay its debt financing plan. And, with the passing of Feb. 15, the government can no longer withdraw from the contract without penalty.

The step-by-step success of the Dixon-Yates plan has been largely a result of Strauss' determined efforts in its behalf. He has had the unswerving support of influential Republican

members of Congress and of the President in his campaign to push the contract to fruition but he has made powerful political enemies, particularly among Democrats who now control Congress.

Strauss' idea of managerial rule has subjected him to pressure and criticism from Democratic Commissioner Thomas E. Murray and others. If the squabble that is basically over Dixon-Yates results in widespread criticism that Strauss is causing delay in important commission decisions on future weapons policy—and a Congressional inquiry could develop that—then Strauss might become expendable as AEC boss.

**Animosity Runs High . . .** Democratic animosity reached a new high personal pitch last week when Strauss came before the Joint Atomic Energy Committee to combat remarks made about the contract earlier by Murray. Murray had charged, statistically, that the Dixon-Yates matter had interfered with other vital interests of the AEC, nibbling away at the commissioners' time and keeping the staff busy for thousands of hours.

Strauss had denied this, and he, perhaps too dramatically, demonstrated his view by piling up in the hearing room four huge crates and a cardboard carton full of AEC documents which had been discussed by commissioners in the last few months. None of these pertained to Dixon-Yates. As a comparison, he put beside him a small packet of four manila envelopes containing all the Dixon-Yates documents discussed during commission meetings in the same period.

Committee Democrats were indignant, Chairman Clinton P. Anderson (D-N.M.) grew angry and grilled Strauss on what types of discussions had been held in commission meetings on Dixon-Yates. Sen Albert Gore (D-Tenn.) criticized the Admiral's display.

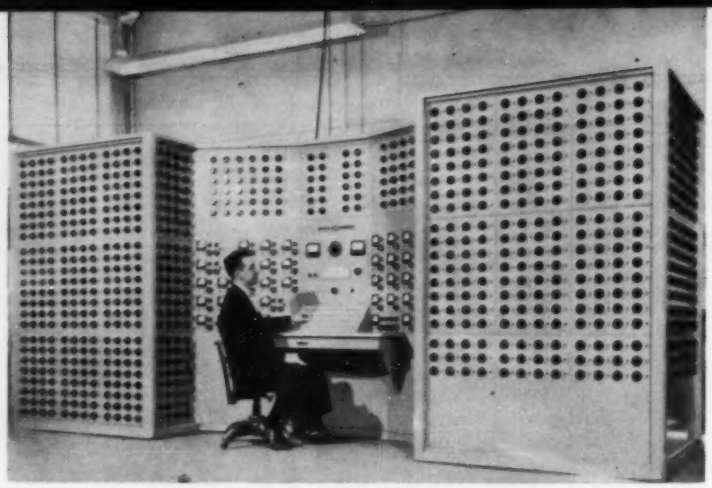
**Walkout . . .** Sen Eugene Millikin (R-Colo.), his patience obviously at an end, accused Anderson of "niggling" in his discourse with Strauss. Sen John O. Pastore (D-R.I.) turned on both the chairman and the witness, declaring that all concerned were wasting valuable time. He said they should "shake hands and get back to our jobs." When this got no response, he stalked from the room.

Within a short time, however, the dispute bogged down, and members accepted a suggestion by Rep W. Sterling Cole (R-N.Y.) that the Dixon-Yates controversy be laid aside until the committee had completed its review of new regulations AEC has just drawn up to implement the 1954 revision to the Atomic Energy Act. Strauss was excused; and soon afterward Democrats were saying his position at AEC has been weakened. Rep Chet Holfield (D.-Calif.) suggested the entire commission resign, particularly Strauss and Murray.

**Cancellation Impossible . . .** The Joint Committee's formal agreement to put aside the Dixon-Yates discussion for at least a month (hearings are adjourned while members attend an atom bomb "shot" in Nevada, and more public witnesses are to be heard beginning Feb. 28) meant that no order of cancellation of the contract could have occurred which would leave the government penalty-free. The contract provides that either side—AEC or Dixon-Yates—could withdraw without penalty by Feb. 15, but after that date, a government decision to cancel makes the U. S. liable for costs incurred by Dixon-Yates in relation to the proposed construction project of the new 650,000-kw steam plant.

As a matter of fact, the commitee's willingness to pass over further discussion indicates that the only serious threat to integration of new Dixon-Yates power with the TVA system, under terms of the contract, is the promise by Democrats on House and Senate Appropriations Committees to withhold funds from TVA which the Administration has asked for construction of new transmission lines.

Mississippi Valley Generating Co, the new Dixon-Yates firm, still must obtain SEC approval of its plan to borrow about $100 million from insurance companies and banks to complete its new plant. But this should be no problem in light of the fact that SEC has already approved the company's request to obtain $5.5 million in equity capital from Middle South and Southern Co.



## New 'Brain' for AG&E's 'Nerve Center'

New analog computer now in service at the "nerve center" of American Gas & Electric Co's system at Columbus, Ohio, is expected to save the company $100,000 a year by facilitating calculations of the most economical means of generating and transmitting power over the utility's vast system.

The giant machine, called a transmission penalty factor computer, is an analog of the loss coefficients of the AG&E system. The computer has 1,290 dials which will be set to express mathematically the system's major load centers, its interconnections, amount of electricity being generated at different plants, and distribution of users in the AG&E service area. It will make possible instant computation of power losses between points of generation and points of use.

The computer was built for AG&E by General Electric Co at GE's General Engineering Laboratory. Both companies cooperated in the design work.

# 'Buy American' Test Looms

**Administration must act on contract for Chief Joseph Dam generators for which English firm underbid Westinghouse**

Major test of President Eisenhower's "Buy American" policy is expected to come in several weeks when a decision is made on awarding Defense Department contract for six generators for Chief Joseph Dam on the Columbia River north of Wenatchee, Wash.

English Electric Export & Trading Co, Ltd, London, submitted low bid of $5,460,361 to Army Corps of Engineers at Seattle for six 64,000-kw generators. This is 13.8% lower than the $6,338,491 bid by Westinghouse Electric Corp.

**First Big Test . . .** The Administration last December announced new Buy American rules cutting the margin by which foreign producers must underbid American manufacturers on government contracts down to 6 to 10% from the traditional 25%. But a few loopholes were left in the President's order which permit agency chiefs to ignore the new percentage differential (1) in the interests of national security, (2) to help relieve unemployment, or (3) as an aid to small business.

The Chief Joseph contract is the first important one under the new Buy American rules. Since English Electric's bid is well under the 6 to 10% differential there should be no question about its getting the contract.

But the Defense Department is under heavy pressure to use the "unemployment" loophole to give the contract to Westinghouse. The American firm would manufacture the generators in the Pittsburgh area, which has been classified by the Department of Labor as an area of substantial unemployment.

**Behind-the-Scenes Fight . . .** U. S. officials responsible for carrying out the President's freer trade program are fighting this move behind the scenes. They contend Labor Department classification of Pittsburgh as a Class 4 unemployment area was based on two-month-old statistics which do not reflect recent rise in employment in the steel industry. These officials say what unemployment there is in the area is largely in the coal mines which would not be eased by slightly higher employment in the heavy electrical equipment industry. A further argument is offered that it would be months before the impact, if any, on Pittsburgh unemployment of awarding the contract to Westinghouse would be felt. In this space of time, the officials say, the whole picture could change.

The matter undoubtedly will land on the President's desk for final decision.

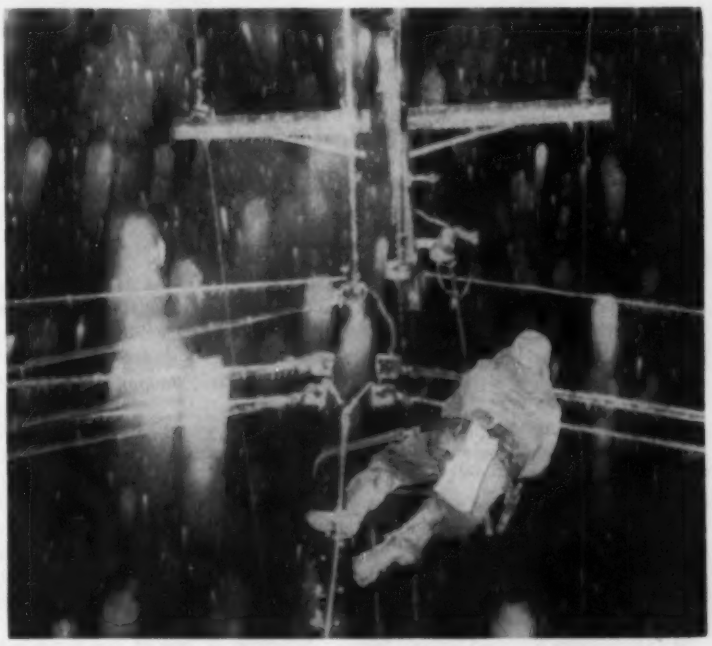
## Government Aid Asked on Copper Shortage

An impending shortage of copper wire bars that represents over 20% of recent uses has led the Wire and Cable Section of the National Electrical Manufacturers Association to lodge an the President's desk for final decision. ficials asking that future deliveries of copper to stockpile be diverted until production can catch up.

In a wire directed to Dr Arthur Flemming, director of Office of Defense Mobilization, and to Sinclair Weeks, Secretary of Commerce, Chairman A. D. R. Fraser of Nema's Wire and Cable Section warned that there is a shortage of approximately 15,000 tons of copper wire bars to meet March orders. This means, he pointed out, that the industry is 11,000 tons short of enough copper to maintain the average level of 1954 production.

In his telegram to the government officials, Fraser stressed the urgency of the situation.

Data on the copper supply situation cited by Fraser was based on a survey of nine out of ten copper companies having rod mills. The Nema data does not include the requirements of certain large electrical and automotive manufacturers who purchase their own copper for future fabrication.



## Repairing a Hot Line in Cold Weather

Lineman for Kansas Gas & Electric Co goes about his job of restoring power service despite subfreezing temperatures and snowfall. The February storm dumped a foot or more of snow on northeastern sections of Kansas.

**Pittsburgh offers seven locations as . . .**

# Engineers Seek New Center

Pittsburgh's proposal to the special committee of the nation's five principal engineering societies studying site offers for relocation from their cramped New York headquarters includes a choice of seven sites. The committee submitted a report to American Institute of Electrical Engineers recommending Pittsburgh as the location for a new engineering center after considering new quarters in New York, Philadelphia and Chicago.

Four of the suggested sites are indicated on the above photograph with an arrow pointing to the Oakland district which contains three sites. Site No. 1 is in the new Gateway Center area at the Point; Site No. 2 is above the Pennsylvania Railroad Station; Site No. 3 overlooks the Amphitheatre; and Site No. 4 is several blocks east of the William Penn Hotel. The Oakland district, which is just past the arrow indicated above, includes Site No. 5, which is the University of Pittsburgh campus; Site 6, property adjoining Mellon Institute; and Site No. 7, at the Plaza Entrance of Schenley Park.

The special committee submitting the report was composed of past presidents of civil, mining, mechanical, electrical, and chemical engineering societies. They are: Elgin B. Robertson, AIEE, chairman; Daniel V. Terrell, American Society of Civil Engineers; Lewis K. Sillcox, American Society of Mechanical Engineers; and Leo F. Reinartz, American Institute of Mining Engineers; and Chalmer G. Kirkbride, American Institute of Chemical Engineers.

Selection of one of the Pittsburgh sites will be determined by approval of the governing boards of the five societies.

# WASHINGTON CHECKLIST

**Hells Canyon**—Federal Power Commission Examiner William Costello estimates it will take him 60 to 90 days to make his recommendation. He will not have to wait for further additions to the record, since Idaho Power Co declined its right to file a final brief.

**Atomic Energy**—Joint Congressional Committee on Atomic Energy will hold a hearing March 8 on appointment of Dr John von Neumann as a member of Atomic Energy Commission.

**Reclamation**—Assistant Interior Secretary Fred G. Aandahl has turned thumbs down on a plan of the Nebraska Public Power Commission to build a government financed 230-kv transmission line from Fort Randall, S. D., to Grand Island. The 1956 budget asks $1 million for a 115-kv line from Randall to Neligh, about halfway to Grand Island.

**Utilities Regulation**—Securities and Exchange Commission filed its 20th annual report, covering fiscal 1954. It said there were 29 electric and gas public utility holding company systems registered as of June 30, 1954, comprising 35 registered holding companies, 133 electric and gas utilities, and 156 nonutility companies.

FPC named Edgar S. Coffman, chief of its Rates Division since 1945, to succeed Wilbur F. Fairlamb as regional engineer of the Fort Worth, Tex., office.

Robert E. McLaughlin, chairman of the District of Columbia Public Utilities Commission, was named to the district's Board of Commissioners. He is succeeded by George E. C. Hayes, Negro attorney.

**Anti-Trust**—Senate Judiciary Committee named the following members to its anti-trust and monopoly subcommittee: Harley M. Kilgore (D-W. Va.), chairman; Estes Kefauver (D-Tenn.), Thomas C. Hennings (D-Mo.), Joseph O'Mahoney

(D-Wyo.), William Langer (R-N. D.), Everett Dirksen (R-Ill.), Alexander Wiley (R-Wis.).

## Bills Introduced

**Atomic Energy**—To authorize AEC to build an experimental nuclear power plant, (S 1049).

**Government-in-Business**—To eliminate federal competition with private business, (S 1003).

**Klamath River**—California and Oregon congressmen have pledged speedy action by Congress on legislation authorizing a compact between the two states over future use of the Klamath River for irrigation and power. Similar bills have been introduced by Rep Clair Engle (D-Calif.), chairman of the House Interior Committee, which will consider the proposal, and by Rep Sam Coon (R-Ore.). Bills would permit a compact to be drafted and submitted to legislature of each of the states.

## Action on Bills

**Reciprocal Trade Extension**—Committee bill (HR 1) voted by the House extending tariff reduction program for three years. The bill now goes to the Senate Finance Committee.

## Tree-Wire-Lighting Problems to Be Aired

Major influence of trees on service continuity and operating costs has prompted sponsorship of the "Street Tree and Utility Conference" to be held at Wade Park Manor Hotel in Cleveland, Ohio, March 3-4.

Joint sponsors of the conference are Edison Electric Institute through its Transmission and Distribution Committee, Street Lighting Committee of Illuminating Engineering Society, and National Shade Tree Conference.

The meeting is designed to promulgate on a national scale the following concept: These services—proper tree selection and planting correlated with utilities' overhead lines and street lighting—can occupy harmoniously the same street with greater advantage to the general public, municipality, and for the electric utility industry.

## Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING DECEMBER

| State | Utility | Plant | Fuel | Capacity (Kw) |
|---|---|---|---|---|
| Me. | Central Maine Power Co | Harris | H | 30,000 |
| R. I. | Narragansett Electric Co | South County | IC | 5,000 |
| Ind. | Indiana & Michigan Electric Co | Tanners Creek | S | 175,750 |
| Mich. | Manton Municipal Light & Power Department | Manton | IC | 448 |
| Mich. | Traverse City Light & Power Department | Brown Bridge | S | 7,500 |
| Wis. | Wisconsin Public Service Co | Weston | S | 60,000 |
| Wis. | Wisconsin Electric Power Co | Oak Creek | S | 120,000 |
| Iowa | Denison Municipal Utilities | Denison | IC | 1,360 |
| Minn. | Northern States Power Co | Mobile Diesel (N. D.) | IC | 760 |
| Kan. | Kansas Power & Light Co | Lawrence | S | 56,000 |
| Del. | Delaware Power & Light Co | Edge Moor | S | 75,000 |
| Va. | Virginia Electric & Power Co | Portsmouth | S | 90,000 |
| N. C. | Tennessee Valley Authority | Chatuge | H | 10,000 |
| Fla. | Florida Public Utilities Co | Fernandino | IC | 2,285 |
| Ky. | Tennessee Valley Authority | Shawnee | S | 135,000 |
| Ala. | Alabama Electric Cooperative, Inc | Gant | S | 15,000 |
| La. | New Orleans Public Service, Inc | A. B. Paterson | S | 81,250 |
| Tex. | Houston Lighting & Power Co | Webster | S | 100,000 |
| Mont. | Montana Power Co | Kerr | H | 56,000 |
| Colo. | Lyons Municipal Light & Power Department | Lyons | IC | 200 |
| N. M. | Public Service Co of New Mexico | Person | S | 30,000 |
| Ore. | U. S. Army Engineers | McNary | H | 70,000 |
| Ore. | U. S. Army Engineers | Lookout Point | H | 40,000 |
| Calif. | Los Angeles Department of Water & Power | Valley | S | 100,000 |
| Calif. | Pacific Gas & Electric Co | Pittsburg | S | 312,500 |

RETIREMENTS

| | | | | |
|---|---|---|---|---|
| Mass. | Haverhill Electric Co | Newburyport | S | 500 |
| Mass. | New England Power Co | Three Rivers | H | 1,000 |
| N. Y. | Rochester Gas & Electric Corp | Rochester No. 11 | S | 900 |
| N. Y. | Rochester Gas & Electric Corp | Rochester No. 34 | S | 750 |
| N. J. | Public Service Electric & Gas Co | Kearny A | S | 20,000 |
| Pa. | Natrona Light & Power Co | Natrona | S | 10,000 |
| Ind. | Public Service Co of Indiana | Rushville | IC | 8,640 |
| Wis. | Wisconsin Public Service Co | Waupeca | H | 250 |
| Minn. | Northern States Power Co | Mobile Diesel (N. D.) | IC | 760 |
| Mo. | Missouri Public Service Co | Pleasant Hlll | S | 1,250 |
| S. D. | West Central Cooperative, Inc | Philip | IC | 1,192 |
| Kan. | Western Light & Telephone Co | Ness City | IC | 240 |
| Kan. | Western Light & Telephone Co | McCracken | IC | 182 |
| Kan. | Kansas Gas & Electric Co | Neosho Falls | H | 275 |
| Kan. | Kansas Gas & Electric Co | Ft. Scott | S | 1,000 |
| Kan. | Kansas Gas & Electric Co | Humboldt | IC | 1,760 |
| Ga. | Georgia Power Co | Augusta | H | 900 |
| Fla. | Tampa Electric Co | Lake Silver | S | 1,000 |
| Ark. | Arkansas Power & Light Co | Little Rock | S | 14,000 |
| Wyo. | Briggs Power & Light Co | Big Piney | IC | 407 |
| Colo. | Lyons Municipal Light & Power Department | Lyons | IC | 100 |
| N. M. | Jemez Mountains Electric Cooperative, Inc. | Espanola | IC | 3,977 |
| Utah | Utah Power & Light Co | Moab | H | 50 |
| Utah | Utah Power & Light Co | Low Mill Creek | H | 1,120 |
| Calif. | California Electric Power Co | 29 Palms | IC | 100 |
| Calif. | Pacific Gas & Electric Co | Bakersfield | S | 20,000 |
| Calif. | Pacific Gas & Electric Co | Midway | S | 20,000 |
| Calif. | Pacific Gas & Electric Co | Station B (Sacramento) | S | 17,500 |
| Calif. | Pacific Gas & Electric Co | Garberville | IC | 385 |
| Calif. | Pacific Gas & Electric Co | Point Arena | IC | 271 |
| Calif. | Pacific Gas & Electric Co | Station A (San Francisco) | S | 15,000 |
| Calif. | Pacific Gas & Electric Co | Station C (Oakland) | S | 12,000 |

| U. S. | Hydro | Steam | IC | Total |
|---|---|---|---|---|
| Added | 206,000 | 1,358,000 | 10,053 | 1,574,053 |
| Retired | 3,595 | 133,900 | 18,014 | 155,509 |
| Adjustments (plus) | 1,850 | ..... | 870 | 2,720 |
| Adjustments (minus) | ..... | 7,000 | 225 | 7,225 |
| Net Change | 204,255 | 1,217,100 | 7,316 | 1,414,039 |

H—Hydro, IC—Internal Combustion, S—Steam

United States Capacity as of Jan. 1—Hydro, 23,184,912 kw; Internal Combustion 2,274,209 kw; Steam, 77,060,935 kw; Total, 102,520,056 kw.

DELEGATES LISTEN intently as AIEE Pres. A. C. Monteith says the Institute is in sound health, despite impending financial problems

## At AIEE Winter Meeting . . .

# Power Progress Is Foreseen

Any electrical engineer who sallied into New York's Statler Hotel—and 4,600 did—earlier this month for the Winter General Meeting of the American Institute of Electrical Engineers was sure to find something to suit his professional taste, regardless of affiliation or interest.

For this year AIEE put on one of the most extensive and diffuse programs of its 70-year history. In five days, during 95 sessions its authors presented 386 technical papers on subjects ranging from ethics to abstract science and from management to metering.

But engineering of tomorrow's electric utility system and its component equipment was a dominant topic. By week's end the discussion had brought out these significant facts:

- Ten years from now some metropolitan utilities will be using 500-600-Mw turbine-generating units.
- For today's conditions the most economical expansion pattern calls for generating units of 10-7% of system capacity.
- To guide generator operation, capability curves, not stator temperature indications should be used.
- Large capacitive loads are presenting stability problems on electric utility systems.
- Formulas for determining transmission loss factors are now relatively more accurate than the fuel cost data with which they are coordinated in economic dispatch calculations.
- It's not always best to use limited hydro in peak periods to free higher-cost steam generation.
- New more-accurate data on characteristics of ACSR conductors are being compiled for all present-day sizes.
- Properly done, 4 ft of frozen oil in pipe type cable can hold a pressure of 300 psi. Freezing can be repeated without damage to insulation.
- Charging current requirements of EHV cable can limit its useful length to 29 miles at 230-kv.
- Distribution economists are turning to mathematical methods, and probability theory is guiding network improvement.
- In electric shock cases the chances of success with counter shock resuscitation are one in seven after two minutes have elapsed.
- As system expansion forces resort to faster and faster ground relay speeds, the chances of false tripping tend to increase.

The details of these and other developments of electrical industry interest at AIEE are summarized on the following pages.

# Turbine-Generator O&M Stirs Session

A proposed new AIEE guide for the operation and maintenance of turbine generators was the center of a swirling round of papers and discussion at the generation sessions. It found manufacturers urging the vital character of operating requirements and limitations, based on design experience, and utility engineers countering by stressing the operating problems and conditions prevailing on large modern metropolitan systems.

Generators should be operated in accordance with the generator capability curves and with rated flow in the hydrogen coolers, C. C. Sterrett and R. A. Towne, Westinghouse, insisted. However, they did say that for loads up to and including the 0.5 psig hydrogen rating, water flow in the cooler should be regulated to maintain the cold hydrogen temperature at a substantially-constant value in the order of 35 to 40C.

There was general agreement among discussers that generator operation by means of stator temperature detector indications is undesirable. Such operation is considered unsafe because the difference in temperature between the detector and the stator copper is a variable which increases at higher hydrogen pressure. In fact C. E. Kilbourne, General Electric, warned that operation by means of stator temperature detector indications is actually dangerous because it gives a false sense of security, especially at high hydrogen pressures. Kilbourne together with GE authors J. R. M. Alger and D. S. Snell presented curves to show this wide non-linear difference in detector and stator copper temperature as a function of hydrogen pressure. These curves were based on theoretical analysis factory and field tests.

**Cold-Gas Temperature** . . . Operators were warned against varying cold gas temperature because the variation of elevation of the generator shaft is a function of this temperature. Wide variation of this temperature could cause misalignment between the generator and turbine shafts. Lowering the cold gas temperature is not a powerful tool for increasing the load because the heat transfer losses of the material between the gas and the armature copper restrict the benefits of the lower temperature.

Some operators said they would like to have an operating curve showing maximum field current as a function of hydrogen pressures. Others preferred to have capability curves plotted for several values of hydrogen pressure in addition to the 0.5, 15, and, 30-psig values.

**Start-up Procedure** . . . Running clearance, gas leaks, collector rings, phase sequence, and insulation resistance should be checked before a generator is started. These were among the operating recommendations urged by GE designers, J. H. Carter and R. E. Gorman. They too described in detail why the capability curves should be used to operate the generator.

**System Operation** . . . Utility operators stressed the problems and practices of large metropolitan systems. One point of agreement was that the hydrogen cold-gas temperature should be held constant. However there were also points of disagreement. Philadelphia Electric Co uses automatic tripping with loss-of-field relays and field preheating on some of its larger units. But Southern California Edison Co doesn't use either practice on any of their machines.

One thing common to some of the utility participants was the problems associated with a system having a large capacitive load. Consolidated Edison Co of N. Y. has at present solved this problem by constructing operating curves based on limitations imposed by field excitation, stator thermal capability, end-turn area heating, steady state "pull out," and loss-of-field relays. Several of the discussions suggested the use of fast response excitation control equipment as another solution.

**Maintenance** . . . Maintenance material compiled from manufacturers' instruction books and AIEE publications was presented by J. W. Jones, Philadelphia Electric. He suggested that such things as collector rings and brushes be inspected daily and that such vital parts as air filters; gas or air coolers; armature windings, core, and frame; rotor terminal bushings; fans; and bearings be given periodic attention. The hydrogen system should also be checked for leakage; he said.

Philadelphia Electric has not had any forced outages attributed to operating practices. This and the fact that internal inspection after the first year's operation have shown relatively little trouble has encouraged the company to extend subsequent complete inspection to as much as five years.

**Auxiliary Power** . . . Problems associated with the transfer of station auxiliaries from one power source to another were discussed in papers giving theoretical considerations and actual operating and test results. D. G. Lewis and W. D. Marsh, General

O. M. BUNDY, Clark Controller Co; C. M. Lytle, Kansas City P&L; and Fred Campbell, Columbus & Southern Ohio Electric

## Generation Session Papers Indicate That:

- Capability curves are most reliable guide for generator operation.
- Large capacitive loads are presenting system stability problems.
- Phase angle relay can be used to initiate fast bus transfer operation.
- Pump storage and hydro generation are profitable.
- Development of small hydro sites is economical.
- Additional study is required on generator field ground detection.

Electric, presented curves showing the decrease in motor speed and voltage during the dead time of a cold transfer. These curves showed:

**1.** The different motors on the bus tend to synchronize.

**2.** Bus residual voltage decays at a rate faster than in the open-circuit case.

**3.** Bus residual voltage and individual motors all decay at nearly the same rate.

Public Service Electric & Gas Co engineers presented test results which have convinced them of the practicability of closing in on a new auxiliary source by means of a phase angle relay sufficiently close to the in-phase point so that a successful and relatively fast throwover can be obtained without damaging the motors.

Lively debate developed on the pros and cons of various bus transfer schemes. American Gas & Electric Co has had 15 years' experience with cold transfers using no intentional time delay. It reported no cases of motor winding stresses attributable to the type of transfer. Detroit Edison Co on the other hand reported a motor failure using this type of transfer and thus is now introducing time delay in the transfer in order to allow the residual voltage to decay.

**Hydro Generation** . . . Pump storage and hydro generation are a profitable operation at the Flatiron Plant because the value of the additional peaking kilowatts made available by the high turbine efficiency is sufficient to pay for the off-peak pumping, according to S. M. Denton and H. O. Britt, Bureau of Reclamation. Two-speed operation of the machine is one of the outstanding features of this plant. It operates at 300 rpm when pumping and at 257 rpm in the reverse direction when generating. In discussion W. L. Ringland, Allis-Chalmers Manufacturing Co, described the features of the two electrically independent stator windings necessary for the two-speed operation.

Development of small hydroelectric sites, which is becoming increasingly important because of the lack of large sites, was described by H. H. Gnuse, Jr, Nantahala Power & Light Co. Gnuse's company has been able to do this economically by building simple plants with remote control. The use of rock fill, earth-faced dams was one method of obtaining low cost design.

**Relays** . . . One facet of ac generator protection that has not received sufficient study is that of detecting grounds in the field windings. J. E. Barkle, C. C. Sterrett, and L. L. Fountain, Westinghouse Electric, reviewed the methods of field ground detection used today. The authors discussed lamp and voltmeter schemes, ac voltage method, dc voltage method, and a non-linear resistor scheme. All of these schemes have a common shortcoming in that they depend on conductivity through the bearing oil film to cause operation, it was said. However, the authors pointed out that a ground return path does exist through the steam in the turbine although they considered this path even less reliable. The existence of this steam path was amplified in the discussion of the paper along with the possibility of ground return through water seal or carbon packed glands.

Stress on the field winding insulation when using either the ac or dc voltage scheme was also discussed. These schemes apply voltage to the insulation higher than the design value, although not higher than the test value of the insulation (10 times operating or design voltage level). Thus the overstressing of the field insulation is a matter of degree.

# Best Size Unit Is 10-7% of System Capacity

If proof were needed today of the concern among system engineers with picking the best size of steam-electric generating unit for system needs, it was to be found at the Power Engineering session's discussion, of a paper by L. K. Kirchmayer, A. G. Mellor, J. F. O'Mara, and J. R. Stevenson, General Electric Co.

The authors had studied a basic system of 2,000 Mw capability, carrying out its expansion to a system capability of approximately 10,000 Mw. Their conclusions from the study were these:

**1.** The maximum economic size of a generating unit has not been reached. Units of 500 to 600 Mw will be used on some power systems in the next ten years.

**2.** The most economical pattern of system expansion is to add units of between 10% and 7% of the size of the system.

**3.** Any increase in the forced-outage rate of larger units above the present 2% will slow up the move to these large units.

**4.** Rate of system load growth has no appreciable effect on unit size that can be justified.

**Unit Size vs Reserve** . . . Leading a parade of distinguished discussors of this paper, M. J. Steinberg, Consolidated Edison Co of New York, observed existence of two opposing schools regarding the effect of unit size on reserve capacity requirements. One school sees no relationship. The other asserts that system reserve requirements increase with unit size.

Steinberg showed that with successive unit additions there is an increase in the percent reserve capacity requirement until a maximum value is reached with the percentage values decreasing thereafter. The rate of increase of reserve requirement to the maximum value varies with unit size. Steinberg also favored the use of probability mathematics for the determination of objective reserve capacity requirements.

Herman Halperin, Commonwealth Edison Co, found the authors' assumption of a 2% forced outage rate slightly low. He favored 3%. Halperin also felt that for large units the allowance for overhauling should be more than the authors' assumed 20 week days per year. He voiced the need for probability calculations to determine possible effect of having a larger-than-average-size unit out of service during a forced outage.

**Load Growth vs Unit Size** . . . C. W. Watchorn, Pennsylvania Water & Power Co, disagreed with the authors that rate of load growth has no bearing on unit size. He failed to see

where smaller units would not be wise with small rates of load growth.

O. R. Bulkley, Southern California Edison Co, said that practical factors, like the size of interconnections, do limit the economical size of units. It's sometimes hard to dispose of excess power through interconnections as unit sizes increase, he said.

H. N. Phillips, Jr, Pennsylvania-New Jersey Interconnection, said the factor of reserve requirements was improperly handled by the authors, that an isolated company will need a spinning reserve of 5% to take care of errors of forecasting. The probability of loss of load would be more nearly one day in 8 years if the 5% rule were applied. The authors assumed 1 in 11 years.

H. P. Seelye, Detroit Edison Co, found the authors' 7 to 10% rule for the size of units in conformity with Detroit Edison practice, but Clarence Paulus, Cleveland Electric Illuminating Co, challenged the authors' tendency to assign no value to capacity above the 7 to 10% rule. Paulus pointed out that a 2-unit station is easier to restore to service than one with six and it's easier to maintain one unit than three. R. D. Maxson, Commonwealth Edison, confessed a leaning in favor of bigger units providing advances in metallurgy permit.

**Steam-Hydro Operation . . .** When a limited amount of hydro energy is available, it is a fallacy to assume that the most desirable operation results from its use in the peak of the load because it makes minimum use of higher-cost steam generation. This fallacy, exposed by C. W. Watchorn, Pennsylvania Water & Power, can cause such large reductions in total hydro-generation, during the period of pondage operation, that the total cost of the (reduced) higher-cost steam generation, plus the cost of the (increased) lower-cost steam generation required is larger than the total of costs for flatter hydro operations.

The best operation, according to Watchorn, is a compromise between that which results in maximum hydro-generation on the one hand and hydro-generation that replaces the maximum amount of higher-cost steam generation on the other hand.

E. E. George, Ebasco, said papers like Watchorn's that seek a basis for the automatic coordination of hydro and steam generation will eventually make computors possible in this area.

**Transmission Loss Evaluation . . .** The elaborate mathematics of transmission loss evaluation has reached a point where, as one discusser put it, the formulas are in danger of becoming more precise than the fuel cost data with which they are coordinated in problems of economic dispatch.

Corrections that make Brownlee's incremental transmission loss formulas even more valid were presented by C. R. Cahn, Syracuse University. He also provided additional numerical examples of the successful use of Brownlee's theory and supplied an extension of Brownlee's theory to give an expression of incremental and total losses which do not require knowledge of generator voltage phase angles. Cahn concluded that the Brownlee formulas appear to be more accurate in most cases than the Kirchmayer loss coefficients.

L. K. Kirchmayer, however, showed that the best correlation between actual losses and calculated losses (using the Cahn, the Brownlee and the Kirchmayer formulas) was given by his method in Cahn's study of the Niagara-Mohawk system. Errors in Cahn and Brownlee formulas result chiefly from the fact that neither one correctly considers the facts of intermediate load and generation when circuits have different X/R ratios, Kirchmayer said. These errors are usually significantly large for transmission systems with different voltage levels and in which transformations occur.

W. R. Brownlee conceded that Cahn's new method presents important advantages over those published previously. The derivation of the constants is much simpler, and some of the more fantastic assumptions are avoided. There is still a suspicion of "w prime" although the treacherous Q/P ratio has been properly relegated to the background. Finally, Brownlee said, the new method is evidence of the growing conviction that adequate coordination of fuel and transmission requires loss constants with primary accuracy of incremental losses, rather than total losses.

In a joint discussion with R. W. Long, Westinghouse, R. H. Travers, Ohio Edison Co, observed that the point is being reached in the development of economic dispatching where loss formulas are relatively more accurate than the basic fuel cost data. He showed that a change of 10% in a group of "B" constants is less serious, dollar-wise, than a 4 to 5% change in plant incremental fuel cost, and in one comparison was less serious than a 2% change in fuel cost. It appears to us, he said, that it is becoming desirable for the steam production people to examine their methods more closely so as to give us better basic cost data for use in economic dispatching.

H. P. Smith, Niagara-Mohawk, observed that apparently the Cahn, Brownlee and Kirchmayer formulas all have about the same accuracy and perhaps the one that is easiest to use should be selected.

## Signs of Progress in Power Engineering

- Most economical system expansion pattern provides new units of 10-7% of system capacity.
- Some utility systems will use 500-600-Mw units in the next ten years.
- Transmission loss equations seen as relatively more accurate than fuel cost data used in today's economic dispatch calculations.
- Incremental-cost-of-power-delivered computer will save an estimated $200,000 yearly on Southern Company system.
- With limited hydro it can be fallacious to assume best operation results from its use in peak to free higher cost steam generation.

**COMPUTER** on Southern Co system maintains incremental cost of power delivered of various units within ± 0.1 mill per kwhr. Production savings approach $200,000 yearly

**New Loss Equation . . .** A new general transmission loss equation was offered by E. D. Early, G. L. Smith, and R. E. Watson that recognizes:

**1.** The effect that the difference in distribution of load among substations has upon both total system loss and incremental loss of the various power supplies.

**2.** The effect that the rate of substation load change has upon incremental loss values.

**3.** There is no restriction upon the maximum bus-voltage phase angle between power supply sources.

W. R. Brownlee, Southern Services, cited it as the first published correlation of arithmetic incrementals with system loss constants. It provides further confirmation of the adequacy of the phase angle method. Of far-reaching importance is the new method for deriving a constant which will take into account a different rate of change for each individual load on the system, Brownlee said.

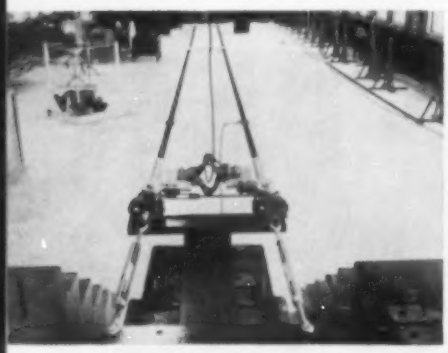
The incremental cost-of-power-delivered computer which has been in service on the Southern Company's system since June, 1954 was described by W. E. Philips and W. T. Shreve, Leeds & Northrup, and E. D. Early, Southern Services. The computer has fully lived up to all expectations. Savings in production expenses resulting from the coordination of incremental production expenses and incremental transmission losses have been estimated at not less than $200,000 a year for the Southern Co's system. Using it, power supply coordinators of the Southern system have had no difficulty in maintaining the incremental delivered cost of the various units at the same level to ±0.1 mill.

# Transmission, Cable Talks Focus on Design

Transmission topics fell in two classes: those concerned with the practicalities of transmission design and construction, and those relating to surge phenomena and the protection of lines and substations.

Common sense approximations in transmission line sag and tension calculations have made it possible for five Southern California Edison Co transmission designers to do the work formerly done by 15. Design simplifications, described by J. Lummis and H. D. Fischer, emphasize sag and tension calculations that produce fixed clearances without exceeding safe values of tension.

Precise relationships between sag and tension are not considered important because sag, upon which ground clearance depends, is the only tangible and controllable factor. Company engineers prefer approximate and faster calculating methods that produce designs within the practical limits of accuracy on the majority of lines. More accurate methods are reserved for unusual cases.



NEW TEST used to fix R and X values of expanded ACSR will yield more accurate design data for all sizes now in use

FREEZING CHAMBER used in tests to determine best freezing practice for pipe cable

## Highlights of AIEE Transmission Meets

- Approximations in transmission design calculation by California company let 5 men do work of 15.
- New tests will provide more accurate data on characteristics of all ACSR conductor sizes.
- Capacitance of cable leads contributed to surge protection of substations.
- Tests on Pepco system give new data on surge attenuation in cables.
- Device measures voltage drop across joints on energized transmission lines.
- Charging current requirements of 230-kv cable can limit useful length to 29 miles for unit power factor current.
- Dry ice freeze of pipe-cable oil 4 feet long is required to hold 300 psi. Freezing and thawing leaves insulation undamaged.

**New ACSR Data . . .** Promise of more precise values of resistance and reactance for all present sizes of ACSR transmission conductors was held out by a new method of measurement described by Joel Tompkins, B. L. Jones, and P. D. Tuttle, Aluminum Co of America. The new test method was first used to secure ac characteristics of 1.6 and 1.75-in. expanded ACSR conductors. Significance, if not the reason for development, of the more accurate data lies in the growing importance being attached today to the evaluation of transmission line losses as a factor in the scheduling of generation, it was pointed out by discusser C. F. Sieno, American Gas & Electric Co.

**Joint Testing for HV-Lines . . .** A new technique for testing joints in energized transmission lines was described by A. S. Runciman and H. Westman,

Shawinigan Water & Power Co. Key to the technique is a device comprising a dc 100-micro amp meter, rectifier, and shunt (adjustable for line current) all mounted on an aluminum frame suspended on rollers from the transmission conductor.

Voltage drop through the joint is read on the micro ammeter from the ground. Readings on equal lengths of conductor before and after the device straddles the joint determines its relative conductivity. These range usually between 0.6 and 0.9 for normal joints, but a ratio of 1.5 detects a joint which will overheat. The device is placed on the energized lines from the ground by means of nylon ropes, which also serve to move it along the conductor.

**Bundling . . .** Bundling with identical 266,800 cm ACSR in lieu of reconductoring with 636 Mcm ACSR was credited by P. L. Lumnitzer and M. J. Fulton with saving $45,000. Their project involves 25.5 mile of 115-kv wood H-frame transmission on the Pennsylvania Electric system near the new 274-Mw Shawville plant. Unusual problems that complicated design were; prior overstressing of line conductors by severe sleet, and the probability that sleet would accumulate on the bundled line.

Today's interest and concern with corona losses and radio interference on transmission lines were the apparent impetus behind a paper by G. E. Adams, General Electric, on transmission line voltage gradients—knowledge of which is especially important in studies of corona loss and RI. He showed mathematically that conductor diameter has the most significant effect upon the surface voltage gradient for practical arrangements, decreasing about 0.8% for 1% increase in diameter. Gradient increases as conductor spacing is reduced.

**Cables Improve Protection . . .** Studies of direct stroke protection of high-voltage switching stations and transformers of the St. Lawrence River Power Project indicate that the capacitance of cable leads to transformers is of considerable value in direct stroke protection. This conclusion, among others, was reported in a paper by S. B. Griscom, J. K. Dillard, and A. R. Hileman, Westinghouse Electric.

The authors showed that with 900-kv BIL transformers and 195-kv arresters at cable entrances, additional arresters at the transformers are unnecessary even with only a single line and single cable in service. When direct-stroke protection is provided, surge voltages are only 7% more severe than those from traveling waves, the authors found. But to secure direct stroke protection, the stations and the first tower span out must be well shielded, and the first tower footing resistance must be 10 ohms or less.

In discussion, H. M. Ellis, Hydro-Electric Power Commission of Ontario, showed that on the Canadian side, lightning outage of lines between the 230-kv cable entrance and the switchyard means loss of ¼ of the generation. Tower footing of 5 ohms or less is necessary to minimize outage frequency. Based on this low resistance, he said, lightning outage probability at the 230-kv cable entrances is one in 30 to 40 years for all four single-circuit lines. J. H. Hagenguth, General Electric, warned that even if the first tower out is shielded, omission of shielding from the second tower can result in heavy currents and surges.

**Freezing of Cable Oil . . .** Increasing reliance on the freezing technique as a tool in the maintenance and rerouting of pipe cable has led to several experimental freeze runs on one size of pipe cable at the Phelps-Dodge Habirshaw laboratory. Edwin J. Merrill said the minimum length of freeze which should be considered under static conditions for a "hard" freeze capable of holding 300 psi is 4 ft. Such repeated dry-ice freezes under hydrostatic heads as high as 300 psi have no bad effect on pipe cable component and may be melted under a head of 300 psi with no bad effects. Pipe oil may be drained from one side and dry gas feed of 25 cu ft per hr may be established one foot from the freeze on the drain side. Dry ice alone, Merrill said, is essentially as effective in holding the freeze as combinations of dry ice with liquid head transfer mediums.

R. J. Wiseman reported similar test results with freezes on pipe cables of different diameters. He noted that it takes longer to obtain a satisfactory freeze on a smaller pipe diameter than a larger one.

Details of gas pressurized, 120-kva, 161-kv pipe-type cable installation in Ontario was reported by Steven Kozak, Canada Wire & Cable Co, and Colin Prescott, Hydro Electric Power Commission of Ontario.

**Critical Cable Length . . .** Higher voltages and higher-capacity lines are focusing the attention of cable engineers ever more sharply on dielectric loss and its effect on the limiting length of extra-high-voltage cables. C. F. Schifreen and W. C. Marble, Philadelphia Electric, demonstrated that as cable voltages and capacity ratings increased, the ratio of dielectric loss to total losses also goes up. For a cable of given voltage of a particular construction, there is a critical length at which charging current equals the maximum permissible conductor current at the sending end. For this length no output current is possible at unity or leading power factors without overloading the sending end of the cable. This critical length is on the order of 46 miles for 132-kv cable, 29 miles for 220-kv cable of the same type and construction. Cable lines whose lengths are greater than the critical length may be operated only with lagging power loads.

L. I. Komives, Detroit Edison, pointed out, however, that some time will elapse before critical length becomes a factor in high-voltage cable application. R. C. Atkinson, General Cable (retired), reinforced this view by pointing out that on present systems cable length is normally a matter of economics. However, it is startling to think that as voltage goes up sharply the usable length decreases.

R. J. Wiseman, Okonite, said his investigations show that a 345-kv pipe-cable, capable of transmitting a 350-Mva load would have a critical length of approximately 25 miles. He called attention to the effect of electrical stress in the insulation on cable characteristics at such extra high voltages.

L. A. Nettleton, Consolidated Edison Co, reported that the total charging current for the company's total of 70 miles of 138-kv cable amounts to an estimated total of 275 Mvar. Looking ahead 15 years, he estimated total cable charging current requirements might be expected to fall somewhere around 600 Mvar. However, he did not expect charging current of any particular cable to be a problem.

F. C. Van Wormer, General Electric, said the critical length of a 300-kv cable of the type used at the Kitimat project in Canada would be approximately 23 miles and that the critical 30-mile length of a 220-kv cable

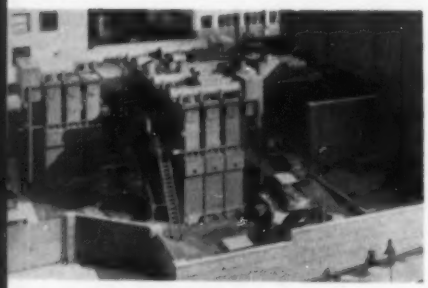
would require a charging current of the order of 250 Mvar.

He also presented an improved approximate technique for calculating cable temperature. He showed that an approximate solution can be obtained by lumping the constant of the cable and forming an equivalent pi circuit. For small conductors with a heavy wall of insulations, further accuracy may be obtained, he said, by the use of the modified equivalent "T" circuit. The work of solving the "T" circuit is somewhat greater than for the pi circuit but is still considerably less than the solution using a distributed constant.

**Surge Attenuation in Cable . . .** With the growing trend to underground circuit in urban areas, problems of providing surge protection for equipment connected to overhead lines through cables are assuming increasing importance. Opportunities exist for cost savings by taking advantage of the short time impulse characteristics of insulation through the use of reduced insulation or fewer lightning arresters. But full advantage cannot be taken of these opportunities without accurate data on the character of the lightning surge voltages impressed on protected terminal apparatus.

A long forward step was the publication by W. W. Valentine, Potomac Electric Power Co; J. K. Dillard and J. M. Clayton, Westinghouse Electric, of fundamental surge attenuation data on 15, 40 and 69-kv class cables ranging in length from 2,000 to over 32,000 ft. Cable tests on the Pepco system showed that attenuation is greatest for 15-kv cable. Among cables of the same conductor size and sheath cross section area, variation in attenuation depends on the difference in shunt resistance. As shunt resistance increases with insulation thickness, this may account for higher voltage cables having less attenuation.

# Distribution Adopts New Methods



SUBSTATION in downtown Pittsburgh features 69-kv pipe cable and metal-enclosed bus

## Engineers Reveal These Advances

- New network substation gets 69-kv pipe cable and metal-enclosed switchgear.
- Distribution economists turn to mathematical methods.
- Probability theory guides network improvement.
- Simple model tests cable heat dissipation in soil.
- Analog measures parameters of switching capacitors and line-charging current.
- Voltage and vars switch capacitors.
- Users rate supervisory control equal to manual for operating reliability.

Pipe-type cable will carry energy into downtown Pittsburgh to supply Duquesne Light's new 85,000-kva network substation. The 1,500-MCM 69-kv cable will also complete a new loop between generating plants, thereby firming up transmission capacity as well as providing duplicate sources for the network. Ultimate installation will provide eighteen 12-kv network feeders with voltage regulated by tap changers on the three main transformers. Cost estimates favored the 69-kv project, said V. E. Hill, and its ultimate capacity provides for 20 years growth.

Placing this substation on a small site imposed critical requirements on design, safety, and appearance, reported E. M. Gue. Solutions were found in placing 69-kv switchgear and main transformers in a walled yard and enclosing 12-kv segregated-phase switchgear and all controls in a 3-story building. Pipe cable terminals and 69-kv bus are metal-enclosed construction tested to 350-kv BIL.

Design of the switchgear was described in a companion paper by P. R. Pierson, Westinghouse. Space limitations for the 69-kv bus demanded major changes. Complete factory assembly checked construction and permitted high-potential tests. Shipment in assembled units facilitated erection.

A fourth paper, by J. E. Schrameck, Westinghouse, described the compressed air system for circuit breaker operation. Features include water-cooled compressors automatically cycled to equalize wear on three identical units, and duplicate units for storing air at 1,000 psi.

**Distribution Mathematics Explored . . .** The amazing growth of distribution loads has stimulated renewed attention to economic design. The new assault employs mathematical techniques of integral calculus and probability to establish optimum parameters to guide design policies. Discussion implied a new round of economic investigations.

In their opening paper, A. H. Kidder and J. H. Neher, Philadelphia Electric Co, broke with tradition by analyzing distribution "in terms of its natural parameters." Among their conclusions were these:

**1.** Secondary voltage boosts in the range 115 to 215 v show little reduction of cost per customer.

**2.** Ability to load distribution circuits in proportion to square root of load density is confirmed.

**3.** Unit substations up to 7,000 kva capability may prove feasible for 4,000 kva per sq mi at 0.95 pf in 4.16-kv distribution.

**Polygonical Areas Guide Planning . . .** Exact locations of loads in urban overhead areas do not change planning parameters of density, substation size, feeder voltage, number of feeders, and feeder voltage drop. These can be evaluated, said W. J. Denton and D. N. Reps, Westinghouse, by analyses of equivalent systems to serve polygonical load areas. Such examination reveals

the desirability of compromise between the two extremes of (1) adding substation capacity at fixed sites and (2) adding substation capacity in fixed increments at new sites.

Economic analysis guided selection by Indianapolis P&L of 397,500-cm ACSR for new 13-kv feeders to convert 4-kv fringe areas to the higher voltage, reported A. W. Funkhouser and R. P. Huber. This size will extend halfway through the load area, then drop to 266,800 cm, finally to 2/0 at the ends. The combination shows lowest annual cost for 10-mile feeders with uniformly distributed load growing 11.6% per year.

Choice of 397,500 cm for the feeder instead of 2/0 cuts voltage regulation by half. Ultimate loading of 6,000 kva will require only one set of supplemental regulators, they said, and some shunt capacitors.

**Probability Guides Network Design** . . . Probability can be a useful guide to design and operation of secondary networks, according to N. M. Neagle and D. R. Nelson, General Electric. Starting point should be equipment outage rates for the particular system. Typical conclusions for a 4-unit vault from published EEI data are:

**1.** All units would be in service 91.537% of the time.

**2.** At least 3 units would be in service 99.720% of the time.

**3.** At least 2 units would be in service 99.994% of the time.

Prompt maintenance of defective network protectors could boost service availability of all units in a 3-unit vault to 97.791%. And at least 2 units would be in service 99.984% of the time. Such performance might eliminate need for a 4th unit, particularly if feeder maintenance could be restricted to non-critical periods.

Further application of probability to secondary networks by D. N. Reps, Westinghouse, revealed these interesting predictions:

**1.** Coincident loss of two feeders out of four serving a 4-unit vault in a 10-feeder network should occur once in 66.7 years.

**2.** Loss of one feeder in the 4-unit vault during a 2-feeder outage on the network occurs once in 17.9 years.

**3.** Network protector failure on one of the 3 remaining units can be expected once in 2,400 years.

**Al Sheaths Cut Ampacity** . . . Aluminum-sheath, 3-conductor cable must have larger conductors than lead sheath for the same capacity, said E. J. Merrill, Phelps-Dodge, in a paper co-authored by W. A. Del Mar. Reason for this is that sheath losses in aluminum run much higher than in lead and require compensatory cut in conductor losses to avoid overheating insulation. Examples cited for 15-kv solid-type cables required cross-sectional increases ranging from 4 to 33%.

Other disadvantages cited for aluminum-sheath cable are difficulty in joining successive charges and the exacting procedure required to splice in the field. The latter, said the authors, is effectively accomplished by tungsten-arc welding in an argon envelope. But wiping can be successful if the sheath is first cleaned and tinned with a 77.18-tin, 20.47-zinc, 2.25-lead solder without flux.

Steady-state heat flow from buried cables is conveniently determined by use of a simple analog, reported E. de Haas, P. J. Sandiford, and A. W. W. Cameron, Hydro-Electric Power Commission of Ontario. The method represents soil by graphite-coated paper, cables and heat sinks by fixed electrodes, and measures thermal resistance with an ohmmeter. Complications such as backfill of different thermal resistivity are represented by stacking layers of graphite paper in appropriate areas.

**Charging-Current Switching Studied** . . . Switching of line charging current and shunt capacitors occupied one entire session. Basic investigation by General Electric engineers verified a representative test circuit and determined, by use of a transient analyzer, circuit parameters controlling recovery voltage. Among these are:

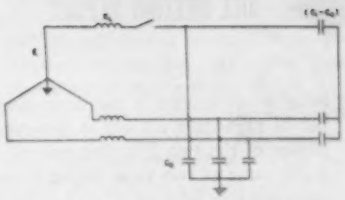
**1.** Peaks reach 2.0, 2.4, or 3.0 times normal line-to-neutral crest voltage of an effectively grounded system on the first pole to interrupt grounded capacitors, overhead lines, and ungrounded capacitors, respectively.

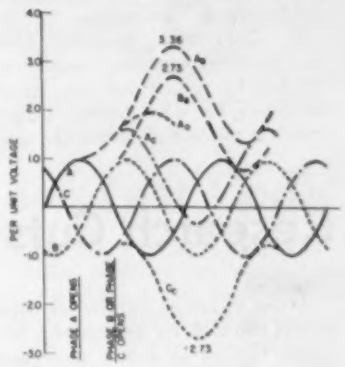
**2.** Restrikes can boost these values greatly.

**3.** Recovery voltage on the first pole to interrupt can be boosted by subsequent opening of a second pole.

**4.** Reactance or resistance grounding of the system can boost recovery voltage on the first pole to interrupt grounded capacitors, cables, and overhead lines. It has no effect on ungrounded capacitors.

**5.** Isolated systems produce 3.0 times recovery voltage across the first pole regardless of capacitance configuration.






**RECOVERY VOLTAGE TESTS** on above analog show capacitor voltage peaks below when switch opens phases in various sequences

**6.** Failure in one phase of an ungrounded capacitor can boost recovery voltage to 3.46 times normal crest.

**New Relay Switches Capacitors** . . . Control of capacitor switching in automatic distribution substations is improved by modified induction-type voltage relays, reported W. C. Osteen and J. J. McCullough, Southern California Edison. Modification consists of a 14-turn current coil wound over the standard potential coil and energized from current which leads potential by 30 deg at unity pf. Sagging voltage and lagging pf both decrease torque on the relay disc permitting it to close capacitor breaker. This device overcomes difficulties encountered with the conventional voltage control.

Difficulties in balancing double-Y capacitor banks led O. R. Compton, Virginia E&P, to comment that he firmly believes in single-Y connection. Balancing of the banks was necessary to reduce neutral current which is used for relaying. Unbalance was caused by manufacturing tolerances of capacitors and by temperature variations from sunlight and from air warmed by lower units passing higher tiers.

Other difficulties with the double Y were brought out in discussion. The

relay won't operate if the same number of capacitors are out in the same phases of the two Y's. But the effect is the same as two units failing in the same section. Because of such difficulties and because solidly grounded capacitors act as lightning arresters, BPA and GE are using and recommending single-Y connection.

W. C. Fowler, Sangamo Electric, described capacitor installations switched by voltage and vars on an Oklahoma PS 4-kv feeder. Circuit load is a mixture of industrial, small commercial, and residential; voltage had been held constant at the substation bus and supplemented by induction regulators. Tests show excellent regulation with switched capacitors after line drop compensation was cut out at the regulators. Voltage spread was less than for either regulators or switched capacitors alone.

**Reviews Supervisory Circuitry** . . . Remote control of substation equipment becomes complicated when automatic reclosers are included. Circuitry by which it can be accomplished was described in a paper by W. A. Derr and W. L. Metz, Westinghouse. They also presented schemes by which automatic synchronizing can be included, and touched on such other functions as remote indication and metering.

Discussers confirmed the complexity of some control problems and urged development of components better suited to dust and atmospheric exposure of small isolated substations. A survey reported by J. J. Winsness for the AIEE Committee on Substations showed 31.3% of switching stations and 6.7% of substations under supervisory control. Preference is for wire circuits, but carrier applications are numerous and microwave promising. Automatic or supervisory control is considered equal to manual in reliability by 79% of the users.

# Research Cuts Transformer Noise

A new assault on transformer noise applies two tools for immediate relief: sound barriers to deflect noise and loud speakers phased to cancel it. Tests by W. B. Conover and R. J. Ringlee, General Electric Co, contribute these facts:

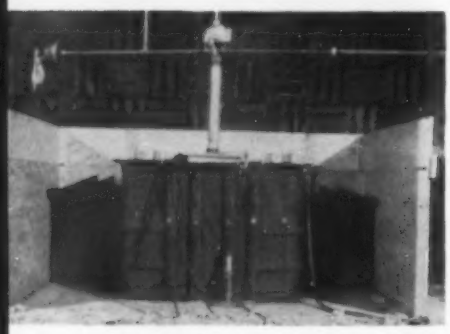
**1.** Scale model transformers simulate sound distribution of full-scale units for laboratory field plotting.

**2.** Attenuation by two or three wall barriers can be predicted.

**3.** Effect of four-wall barriers does not correlate with either height or distance from transformer.

**4.** Sound cancellation cuts noise in 35 deg angle by 6 db or more and up to 20 db at a given point.

Ultimate solution of transformer noise is a long-term project involving basic metallurgy, structures, and electrical design. Progress in this direction is expected from the new anechoic chamber recently completed by GE. Its facilities permit evaluation of changes in noise level of 1-2 db.



SCALE MODELS in laboratory test effect of sound barriers for 125-Mva transformer

## Progress Shows in Many Developments

- Transformer noise yields to sound barriers.
- Loud speakers beam zone of noise relief.
- Gamma bombardment shatters insulating liquids.
- Oil-less transformers reach new heights.
- Functional tests offer distribution transformer savings.

**Urges New Appraisal of Life** . . . Realistic appraisal of the effect of distribution transformer loading on life expectancy was urged by A. M. Lockie, Westinghouse Electric Corp. Potential advantages are operating economies of heavier loading and manufacturing economies in new insulating systems. These and similar problems, said Lockie, require a standard method of rating and for applying this rating to field conditions. Best source of information on which to establish these standards is functional testing of full scale samples.

Reliable service to distribution customers depends to some degree upon impulse strength of the transformers. But the relatively high turn ratios induce excessive voltages in the primary when the standard 1½ × 40 test waves are applied to the secondary terminals. J. E. Holcomb, GE, advocates use of 1 to 2-micro sec waves more representative of those on secondary conductors in the field. Such waves do not overstress the primary.

Core magnetization can cause changes in neutral current observations of transformer impulse tests, reported J. E. Holcomb, M. F. Beavers, and L. C. Leoni, all GE. And magnetostriction noise can be misinterpreted as insulation failure.

J. W. Kalb and A. G. Yost, Ohio Brass Co, cited the need to explore performance of lightning arresters under severe service conditions. Among those mentioned were highly reactive circuits, stroke polarity opposite to coincident power voltage polarity, multiple strokes, and switching surges. Discussion implied that other manufacturers recognize the need to accumulate such data looking toward possible revision of testing standards. W. S. Price, American G&E deplored present necessity of applying equipment without full knowledge of performance.

**Oil Research Continues** . . . K. W. McFadyen, GE, reported on fundamental study of moisture and gas in transformer oil. He said relationships of moisture solubility in oil were found in agreement with basic laws governing dilute solutions. Tests show the log of solubility of water in oil is directly proportional to the reciprocal of abso-

lute temperature. This provides means of accurately extapolating data to determine saturation over the full range of interest.

Controlling factor in quantitative correlation of water and many electrical properties of dielectrics is believed to be relative moisture saturation, said MacFadyen. This saturation of transformer oil was found to be linearly related to relative humidity of the atmosphere in which equilibrium was established.

Gamma radiation can transform liquid dielectrics into solids or decompose them into acids and gases, said T. D. Callinan, Naval Research Laboratory. These changes can be calculated and even suppressed to some extent by available additives. However discussion brought out that the transformation varied with amount of oxygen present and would be less severe with oxygen excluded.

**Dry Types Reach New Highs . . .** Transformers of the future may depend less upon oil if developments continue in dry types. Functional testing of silicone glass fibre insulation demonstrates that 15-kv transformers are practical, said M. L. Manning, Pennsylvania Transformer. Tests and service experience with 100 transformers indicate that hottest spot temperature rise may reach 180C.

Tests reported by G. F. Simmons and A. L. Scheideler, GE, suggest that dry-type construction with organic impregnants can operate above 200 C if silicones are applied as the final treatment.

Compressed fluorinated gas cools a 138-kv current transformer described by G. Camilli, GE. And low-voltage units have been successfully molded in epoxy resin by W. C. Farneth and George Gallousis, Allis-Chalmers.

# Engineers Call for New Switchgear Test Code

## Switchgear Progress Takes Many Forms

- New circuit breaker test code urged to clarify relative merits of field and laboratory tests and fix criteria for proving performance.
- 138-kv, 5,000-Mva breaker withstands 6,900-Mva duty in field tests on AG&E system.
- Two-phase-to-ground short circuits can yield currents 15% greater than 3-phase or single phase short circuits—but seldom do.
- New volume theory of dielectric breakdown of oil finds it controlled by peak stress, volume feeling stress and electrode distance. Ignores time; but tells why.

Confusion over the relative merits of full-capacity field tests and high-capacity laboratory tests of new circuit breaker designs has led to the recommendation that a new test code be drafted to put each in proper perspective and establish criteria that breaker manufacturers must meet as proof of design performance.

This recommendation was made by Earl Reitz, General Electric Co, in commendation of the paper by Otto Naef, American Gas & Electric Co, and R. D. Hambrick, Federal Pacific Electric Co. The paper presented results of a field test on a new 138-kv, high-speed oil circuit breaker design at Philip Sporn power plant. During these tests a breaker duty of 6,900 Mva was successfully imposed on the 138-kv breaker, nominally rated 5,000 Mva.

R. E. Fredrick, Westinghouse, questioned the 6,900-Mva duty as a basis for that high a rating of the test breaker. From results of the field test a rating of 5,400 Mva would be justified on the asymetrical basis, 4,625 Mva on the symetrical basis, he said. Better proof of rating could have been had if test had been conducted in a high power laboratory where contact parting could have been controlled to give more severe arcing conditions.

C. J. Ballentine, GE, said that field tests only supplement laboratory tests and have to be limited in extent. Many tests must be made over the full range of ratings to prove a design, and this can best be done in the laboratory. Both Ballentine and Earl Reitz, GE, noted, however, that makers of the test breaker had established a 5,000-Mva rating by these tests and were apparently well on their way to a 10,000-Mva rating.

R. E. Kane and J. K. Walker, Westinghouse Electric Corp, reported successful interruption of 5 million kva by a 69-kv new compressed-air breaker in the company's high power laboratory. The laboratory testing circuit was said to have been made more difficult than any known field circuit for a grounded or ungrounded system.

**Use Resistors in Breakers . . .** Resistors of relatively low ohmic value (2,400 ohms) proved effective in enabling oil circuit breakers to interrupt heavy line charging currents of a 230-kv system, reported D. J. Marsden, Federal Pacific, in a paper prepared jointly with D. M. Umphrey. Direct advantages of such resistors are ease of accommodation in existing breakers, control of voltage division in a multiple-break breaker, and their ability to modify circuit conditions during breaker operation.

But hundreds of breakers have given years of successful service without resistors. The authors attributed this performance to persistence of restrike current for several natural half cycles until contacts separate enough to clear without restrike.

Two-phase-to-ground short circuits may result in currents up to 15% higher than those associated with either 3-phase or single-phase-to-ground short circuits, according to an analysis by W. S. Skeats, GE. He said that 2-phase-to-ground short circuits can result in normal frequency recovery voltages equal to or higher than line-to-line voltage if the two phases are not cleared within a fraction of a half cycle of each other. However, Skeats pointed out that such high short circuit currents in 2-phase to ground faults require the combination of so many unfavorable circumstances that they should be very infrequent in service. However, Otto Naef, American Gas & Electric, reported having experienced one serious breaker failure which he said may have been due to these type of circumstances.

General Electric Photo

STEEL-CLAD BREAKER of impulse type, rated 330 kv, 25 million kva, installed at Philip Sporn Station. Unit weighs 83 tons

**Lenticular Circuit Breakers . . .** Companion papers by General Electric authors concerned themselves with that company's line of high-capacity steel-clad impulse breakers covering the range from 138 kv and 10,000 Mva to 330 kv and 25,000 Mva. In seven years experience with these breakers C. J. Ballentine and K. G. Darrow reported that interrupter contacts had withstood 70 faults with an integrated duty of 465,000 amp. Enough background has been accumulated to make possible the design of still higher voltage and higher interrupting ratings with proven components.

Author Ballentine reported that although the 330-kv breaker design uses a single-pole operating mechanism, there is only 2/10 of a cycle time spread in contact parting time. No relaying difficulties have been encountered, and operation has been as good as that with the 3-pole operator used on 138, 161, and 230 kv designs.

One of the most interesting disclosures at the switchgear section was contained in a paper by W. R. Wilson, A. L. Streater, and E. J. Tuohy, GE, that showed dielectric breakdown of oil does not occur at regions of highest electric stress in the breaker. But it is controlled by combination of factors including peak electric stress, the volume of oil which feels this stress, and the distance to the opposing electrode.

In explaining why time was not given as a factor affecting breakdown, A. H. Sharbaugh, GE, advanced the theory that minute particles floating into the field of stress cause delayed breakdown. Dust particles as small as one-tenth of a mil in a two-mil gap can lower dielectric breakdown by a factor of three, he said.

**Capacitance Switching Tests . . .** The importance of capacitance-switching tests with the increase in the number and length of the high-voltage transmission line and cables and in the use of capacitor banks as highlighted in a paper by R. L. Williams, L. L. Mankoff and H. N. Schneider, GE. They described a synthetic circuit for investigating the capacitance-switching characteristics of developmental interrupters and breakers, for use in capacitor switching on utility systems. This synthetic circuit utilizes relatively low power equipment at a small test area. In essence the circuit supplied capacitive current from a low-voltage source and high-test voltage from a low-current source. Synchronous isolation of the two powers supplied is provided by means of a device designed for the purpose.

Philip Barkan, GE, showed how an analysis of breaker dynamics can be analyzed by simplified mathematics and so provide a stepping stone to more elaborate analysis of breaker linkage design with automatic computers.

**TVA Tests Air Break Switches . . .** TVA engineers presented a group of papers reporting tests on 161-kv air-disconnect switches, high-voltage busses, and insulators. General conclusions drawn from 374 tests on new switches submitted by A. M. McNerney, TVA, were these:

**1.** Single contacts are inadequate for high current ratings.

**2.** Reinforcing blades, increasing number of contacts, using an "in-line" arrangement, or using reverse-loop contact construction permit re-rating 1,200-amp switches to 62,000-amp momentary rating.

**3.** Older type switches have higher short-time capability than the standards in effect when manufactured.

**4.** Standard factory temperature test conditions should be made more exacting.

As a result of short circuit tests on high-voltage busses and insulators, TVA engineers R. M. Milton and F. Chambers suggested improved equations for obtaining forces on insulators that give lower values than those obtained with the presently accepted formula. Wide variation between the test results (calculated forces and actual deflection vs actual force and corresponding deflection) introduced a reasonable doubt that the forces on the insulators were as high as was indicated by the accepted formula.

## Cathodic Control Goes with Grounding

Electrode configuration making electrical contact with the soil should provide lowest ohmic resistance which is economically feasible, L. P. Schaefer, Hinchman Corp, told the cathodic protection section. This is true for electrical grounding and is also a basic criterion for ground beds which supply corrosion control for buried metallic structures. Thus, good electrical grounding can be combined with adequate corrosion control.

This is accomplished at substations with resulting low resistance by using heavily zinc-coated steel rods, in which the zinc acts as the anode. If greater driving voltage is desired, magnesium can be used as the anode material. Where a 25-ohm range is satisfactory, zinc ground rods can be used.

In other parts of the system and at industrial plants the same philosophy of eliminating dissimilar metals and applying cathodic anodes holds true. In cases of excessive corrosion it may be more economical to use a rectifier-supplied ground bed and zinc-coated steel rods.

Steel grounding seems preferable and more economical and results in minimum corrosion, said O. W. Zastrow, Rural Electrification Administration, in describing experience with corroded anchor rods that were bonded to the multigrounded neutral. Other methods cited for relieving the galvanic corrosion caused by copper ground rods were the use of strain insulators in guys and galvanic anodes. One method breaks the current path; the other diverts the flow.

# Speakers Give Tips to Industry

A lively discussion of power rectifiers for industry captured the interest of delegates attending one of the industrial sessions. The much-improved germanium power rectifier now can take its place beside copper-oxide and selenium rectifiers. It may even replace them in some jobs.

Two General Electric authors cited these advantages for germanium dc sources: High efficiency, low regulation, good stability, small reverse current, high inverse-voltage rating, and small physical size. They are competitive in first cost and require little maintenance. One cell can take a 30C rise over a 35C ambient. It operates at a current density of almost 1,000 times greater than copper oxide. One of these "dime size" wafers, when properly cooled, can rectify as much as 3 kw. Ratings of 12,000 amp at 130 v, 16,000 amp at 65 v, and 40,000 amp at 24 v are now available.

**Mechanical Rectifiers . . .** On the other hand, mechanical rectifiers are considered satisfactory by Hooker Electrochemical Co, Niagara Falls, N. Y., and better performance is expected in the next few years. But future improvements in the machines are imperative, asserted K. McCaskill, Hooker electrical engineer. They must be made more stable during power system disturbances, and some way must be found to restore load quickly.

Comparing mechanical and mercury rectifiers, McCaskill said his company had 40 outages per frame on mercury units during 1953 at the Niagara plant, and 45 per machine. But when the over-all figures for the first five years of operation are in, the mechanical units may prove to be the less troublesome. Backfiring is the main operating difficulty. This ordinarily requires contact replacement (sometimes in from 5 min to 5 weeks). But this is somewhat offset by the machines' electrical efficiency of 97%.

Otto Jensen, I-T-E Circuit Breaker Co, countered with a rebuttal. Engineers are working to increase the normal life of contacts, he said. They have found two trouble-causers already and are correcting future designs. Some present machines are giving excellent service. He cited a machine in Hawaii that has run 3½ yr without contact replacement.

A. F. Paskevich, Solvay Process Co, Syracuse, N. Y., reported that glass bulb type rectifiers are sturdy enough for industrial use. Anode compensators can be used to encourage each bulb to carry its share of the load.

**Sacrificial Poles . . .** Despite conventional lightning protection on five miles of single-circuit, 13.8-kv distribution line feeding Kaiser Aluminum & Chemical Corp's reduction plant at Chalmette, La., from one to six outages were suffered each day in 1952 because of lightning storms. Engineers noticed that most strokes occurred on a low, short distribution line linking two gas-engine buildings. These well-grounded buildings stood 66 ft tall at their centers in contrast to the much-struck ground wire which was only 34 ft high.

It was decided that the large buildings attracted the big cloud area needed to generate a lightning bolt. But the lightning, instead of striking the taller building, sought out the lower ground wire which, of course, had a small radius. Installation of vertical rods on the edges of the buildings ended this aspect of the trouble. The rods provided point contacts for the lightning discharge.

It was also noticed that lightning traveled horizontally on the ground wire (over the five-mile distribution line) until it reached a turn. Then it right-angled to the vertical riser, started down the pole, arced to metal braces on the cross-arm, and surged into the 13.8-kv system.

This was solved by a "sacrificial pole" which extends the ground wire straight ahead for about 30 ft beyond the pole at which the line turns. Lightning now darts to the sacrificial pole and is grounded without ceremony.

**New Wire Insluation . . .** Wires insulated with Alkanex, developed by GE engineers, have withstood 300F temperatures for six months, emerging from this baking test without signs of deterioration or loss of insulating strength. Conventional wire enamels failed completely in the same test. Motors now rated at 20 hp may be upgraded to 25 hp, without size increase, because this organic enamel is stable at Class B temperatures.

## "New" Is Keyword for Industrial Group

- **Germanium power rectifiers promise to replace copper oxide and selenium in many industrial applications.**
- **"Sacrificial" poles grounded a serious Louisiana lightning menace.**
- **Wire enamel may upgrade motor hp without increase of size due to its heat-resistance qualities.**

**BUTTONHOLED by Felix Quirino, Convair, C. J. Herman, GE, amplifies Alkanex paper**

## Heat Pump Future Becomes Brighter

**1.** The future of the heat pump is bright. More and more utilities are putting promotion behind it. But better ways than electric resistance heating must be found to provide its supplementary heat.

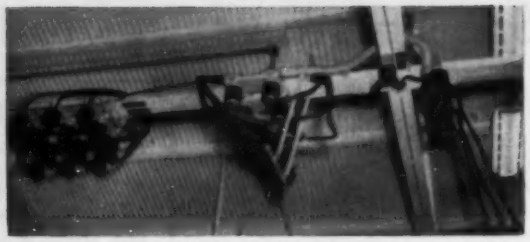
**2.** Electric space heating is a good and desirable load. To support this, Tennessee Valley Authority offered some valuable new data.

These two points summarize the electric space heating and heat pump sessions.

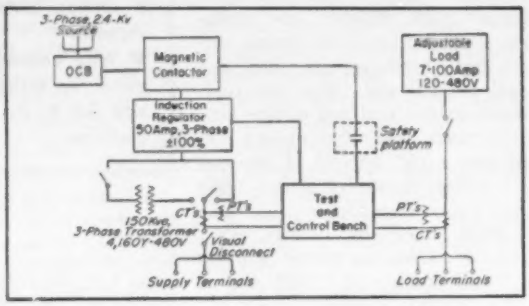
Built-in electric resistance heating units as heat pump supplements still leave much to be desired, concluded

(*Continued on page* 189)

LINE AND LOAD METERING transformers are located directly behind the test bench. Sliding gate interlocks electrically for maximum safety



REMOTE CONTROL of this disconnect switch in the supply circuit is afforded from the test bench. Switch is easily seen from bench




REGULATORS AND TRANSFORMERS up to 2,000-kva capacity may be fully tested as diagrammed. Materials-handling equipment help cut costs

# System Equipment Tests Facilitated

## Multi-purpose bench for testing regulators, and transformers has front-panel controls, remote control from console and precision instrument transformers

M. A. **FREDRICKSON**, Test Superintendent, Shop and Test Div., Southern California Edison Co, Alhambra, Calif.

New multi-purpose facilities have been provided by Southern California Edison Co for testing regulators and single-phase and polyphase power transformers up to 2,000-kva capacity. Incorporated in this test unit are these features:

**1.** Modern test bench with front-panel controls for minimum interference with instrument reading.

**2.** Remote control of test operations from a console-type test bench.

**3.** Multi-range precision instrument transformations for simplified metering and low values of currents and voltages in test bench circuits.

**4.** Electrical interlocks, safety platform, warning lights, and test floor barriers for maximum safety.

Test bench is made by adding a special top section to a standard steel office desk. This section, with aluminum frame and a formica top, serves a dual purpose. It raises the instruments to a suitable level above the desk and provides a housing and panel for components and controls. Desk drawers are ideal storage spaces for instruments, tools, test reports, etc.

The 2.4-kv, 3-phase supply for the multi-purpose test facilities has overload protection through a relay-controlled oil circuit breaker. This breaker is switched under load through an oil-filled magnetic contactor. A 100-amp, 2.4-kv, 3-phase induction regulator with 100% buck or boost provides a test voltage continuously variable from 0 to about 5 kv. An alternate high-current test supply up to 500 v is obtained by routing the output of the 100% regulator through a 150-kva, 4,160 wye/480-v, 3-phase transformer.

Supply circuit passes through an overhead visual disconnect switch, operable from the test bench. The circuit terminates at an overhead connection board from which leads can be run directly to the bushings of the unit under test. Located above the test floor are terminals connecting to a resistor load unit. This load is adjustable from 7 amp at 120 v to a maximum of 100 amp at 480 v.

Line and load metering is handled through instrument transformers located in a screened enclosure immediately behind the test bench. The sliding gate of this compartment is electrically interlocked to insure closure when test circuits are energized. The magnetic contactor and regulator are remotely controlled from the test bench. Other special switches at this bench permit the following tests to be made without any interruptions or changes in leads or instruments: Ratio and polarity, phase relation and rotation, exciting current, core loss, impedance, and buck and boost percentages and compensation on regulators.

Reduction in handling costs resulted from location of the test facilities adjacent to Edison's shop and storage facilities. Use of modern industrial trucks also cuts costs.

GROUP watches stock trading at Merrill, Lynch, Pierce, Fenner & Beane. Third from left is T. W. Fowler, partner, MLPF&B, who has just discussed financial policy. "Common stockholder is the real owner of your business, keep his interests in mind," he advised

# Irving Trust Runs Financial Seminar

## New York bank gives 8-day course for utility executives to acquaint them with the operations of the financial community

There can be more to banking than just money. It can include, as in the case of Irving Trust Co of New York City, a course for business executives on the complex operations of the New York financial community.

The Public Utility Department of Irving Trust recently opened the first regular session of a series of financial seminars for public utility executives. Under the leadership of Vice President John F. Childs, 14 utility executives were given a concentrated 8-day course. The seminars are in addition to the bank's well-known Public Utility Round Tables, held seven times a year and now in their eighth year.

Experts with years of experience in their various fields conducted the classes. The functions of rating agencies were detailed by Fitch Investors Service, Moody's Investors Service, and Standard & Poor's Corp. H. A. Young, partner, Eastman, Dillon & Co, lectured on the broker and the dealer. S. R. Shaw, Josepthal & Co, explained function of arbitrager.

Vice Presidents L. S. Storrs and H. M. Olsen, and G. W. Smith, Stone & Webster Service Corp, discussed financial policy. F. W. Page, vice president, Tri-Continental Corp, explored the same subject as a buyer of common stocks. T. R. Finder, partner, Beekman & Bogue, covered the lawyer's place in a security offering.

Dr Herbert B. Dorau, New York University, and M. J. Reis, vice president, Reis & Chandler, Inc, talked on elements of fair return. Security analysis was explained by R. E. Benson, Equitable Life Assurance Society, and Charles Tatham, Jr, vice president, Institutional Utility Service, Inc.

The group also visited the New York Stock Exchange and had its operations explained by Vice Pres P. L. West. And a talk on dealing with the financial press was given at the Herald Tribune by Donald Rogers, financial editor.

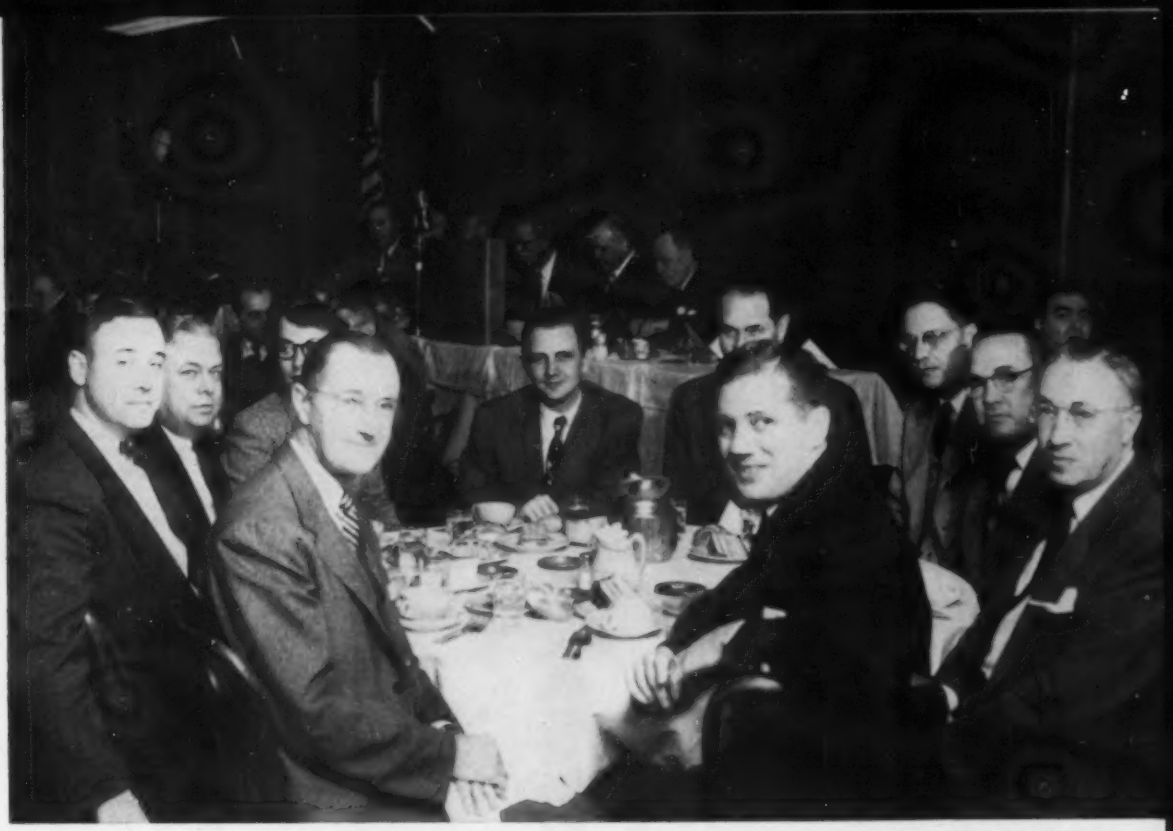
Attending the class were M. Carey and A. M. Clement of Virginia E&P; L. G. Roemer, Wisconsin PS; R. Wardle, Jr, Georgia Power; J. A. Dunlap, Metropolitan Edison; E. D. Ruble, Pacific T&T; G. Ingram, Natural Gas Pipeline of America; J. Stansbury, Consolidated Natural Gas; J. V. Colley, Dayton P&L; R. W. Britt, General Telephone of Illinois; F. A. Keane, Public Service E&G; D. M. Lane, El Paso Electric; W. A. Gemmel, South Jersey Gas; and J. F. Furlong, Central Hudson G&E.

(*See pages* 106 *and* 107)

RATING agencies, the executives are told on a visit to Moody's Investors Service, "consider every factor affecting the credit of a company in arriving at a rating. But final decision is matter of judgment and not a mathematical formula," say Moody's officials

## Irving Trust Co's seminar gave the utility men quick review

FIRST Boston Corp Vice Presidents J. A. Lyles and G. L. Perin (head of table) go into the many functions of investment banking. "Your investment banker is in touch with buyers who are interested in various types of securities—seek his guidance," they tell group

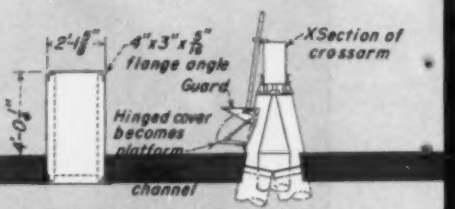


ATTENDING Security Analysts' luncheon, seminar hears searching questions thrown at industry leaders by analysts. These luncheons have become a "must" for those companies which plan to keep their stockholders well informed on the status and progress of the firm

## of complex operations of the New York financial community

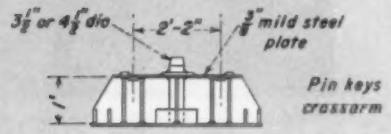
BACK at Irving Trust board room, the seminar listens to Richard S. Nye, partner, Georgeson & Co, on proxy solicitation. Most important part of proxy work, they are told, is handling the day-to-day procedures that lead to development of good stockholder relations

# For 300-Kv Kemano-Kitimat



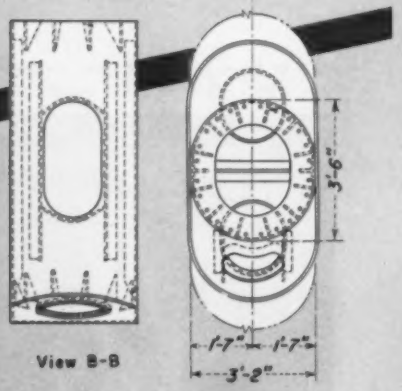

Crossarm and Accessories

*Top and side views of crossarms*




Elevation
Cap Details

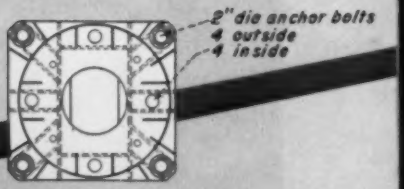
*Hollow tubular sheets of aluminum large enough for a tunnel*




View B-B

Top View of Head A-A

*Details shown here are different eye levels of exploded view across*

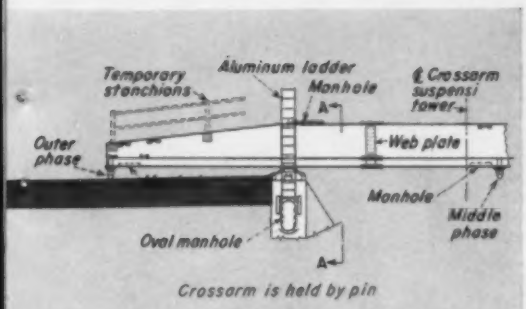


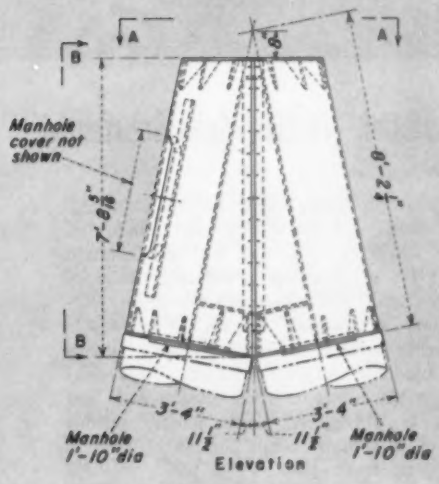

Shoe for Legs No. 1, 2, 3, and 4

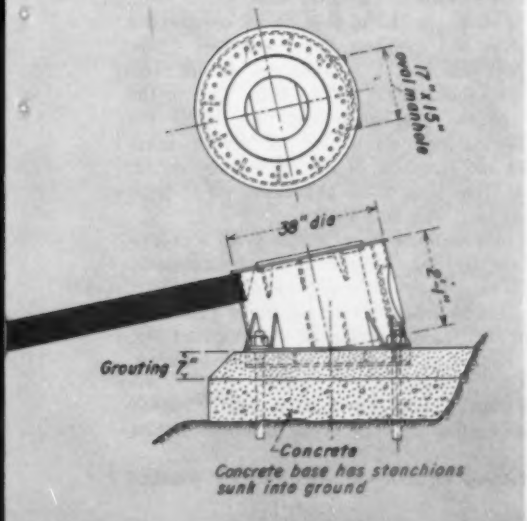
*Shown above is a look down view of base*

# *Line, Alcan Is Sold On . . .*

# ALUMINUM FOR TOWERS




## AVALANCHE STRIKES LINE

**An unusual avalanche late in January in the Kildala Pass toppled three towers, two aluminum and one steel. The lines were severed, and aluminum production was halted at Alcan's Kitimat smelter. For additional details see EW, Feb. 14, p8, also p84 of this issue.**

Aluminum towers are part of the 49-mile, 300-kv transmission system of Aluminum Co of Canada's Kemano-Kitimat project in northern British Columbia (EW, Jan. 21, 1952, p 32; Nov. 1, 1954, p 77). This double-circuit transmission system will carry a firm output in excess of 1,260 Mw from the underground Kemano generating station to the Kitimat aluminum reduction plant. Through nine miles of the route, two single-circuit lines of 2.295-in. dia. 3,364-MCM ACSR conductor are carried, one on aluminum towers and the other on conventional lattice-type galvanized steel towers.

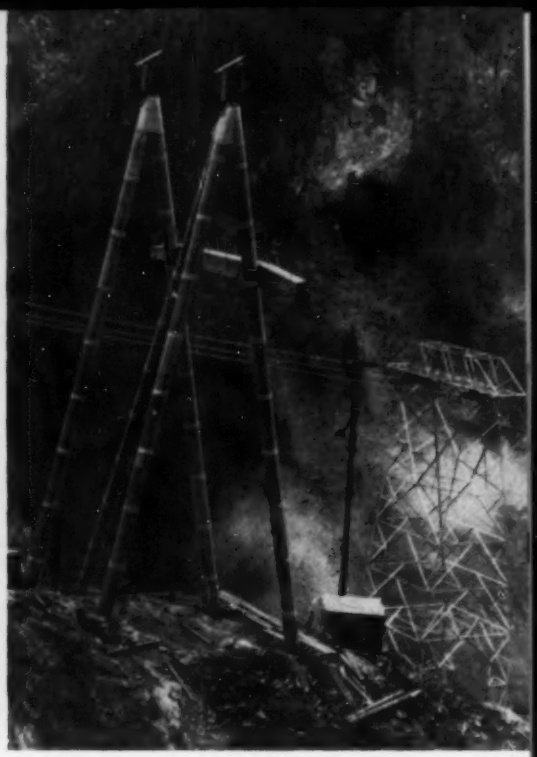
The first ten miles of the system, beginning at Kemano, are two double-circuit steel tower lines along the Kemano River Valley to an elevation of about 1,000 ft. From a switching station two single-circuit lines are built over mountains through Kildala Pass to the Kildala River Valley. The pass is extremely rugged, glaciers having carved narrow valleys and steep cliffs, and the valley floors and slopes are covered with detritus. After traversing the pass, the lines terminate in another switching station in Hanging Valley, from whence two double-circuit lines complete the transmission system to Kitimat.

The terrain and extremely heavy loading of ice, snow, and/or wind prompted installation of the second circuit through Kildala Pass to assure reliable service to the aluminum smelter. Galvanized steel was then in short supply because of the Korean War; so aluminum was chosen.

**Elevations . . .** The aluminum tower line, starting 1,067.5 ft above sea level, climbs about 7,000 ft along a slightly S-shaped route to the 3,600-ft Twin Peaks. It then descends, attaining its longest span, 2,592 ft. The line then rises to the maximum altitude of 5,136.6 ft in Kildala Pass, mostly through funnel-shaped Glacier Creek draw.

---

This engineering report is based on the paper, "The Single-Circuit Aluminum Towers Used on the 300-Kv Kemano-Kitimat Transmission Line," in The Engineering Journal, Vol. 37, No. 11, by Dr K. Sutter, F. L. Lawton, and A. Soosaar, all of Aluminum Laboratories Ltd



## Less Weight, Components, and Ease of Fabrication, Transportation Erection Mean Substantial

Descending, it spans 2,184 ft over a glacier and drops into Hanging Valley.

Over such terrain the line is far from straight, and tangent spans are few. Maximum angles are about 41 and 32 deg. Through Kildala Pass both single-circuit lines run side by side, but not parallel. Rocky hummocks and the threat of snowslides narrow the latitude for tower sites, and lines occasionally converge to the minimum center-to-center separation. In 45,320 ft the line has 34 spans, ranging from 2,592 to 634 ft. Tower material was shipped by barge from Victoria, B. C., to Kemano Bay, Kildala Bay and Kitimat Arm and hauled by truck to tower sites. Many deliveries were made by highline.

**Braced H-Frame and Box Girder . . .** The aluminum towers are braced H-frame structures of five thin-walled, 38-in. overall dia. tubular aluminum legs. The legs are arranged as an A-frame and a tripod, and they carry a box-girder-type aluminum crossarm resting freely on caps and guided by pins. Caps are bolted to heads in which the A-frame and tripod legs terminate. On two of the 35 towers the A-frame has been replaced by another tripod.

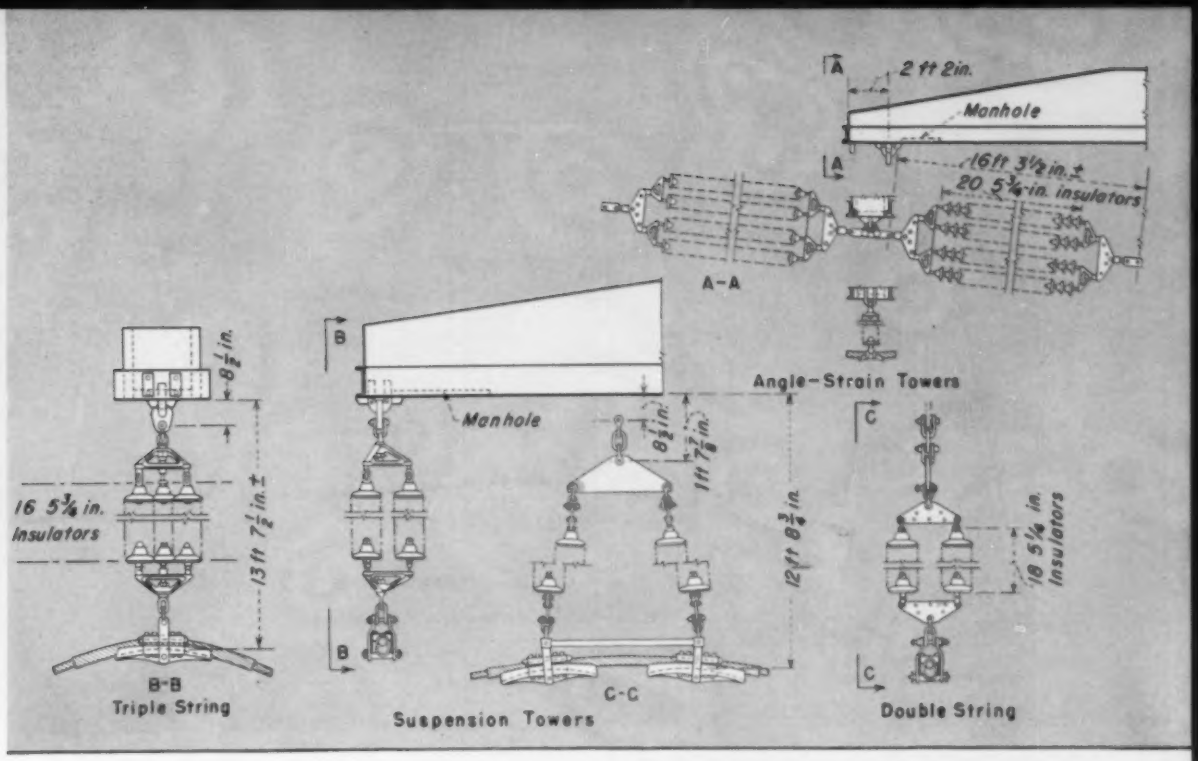
The aluminum tubular legs are sections bolted together internally. Four or more 2-in. dia. bolts anchor tower legs to foundations. The towers vary from 139.5 to 74 ft, height being the average vertical distance of all legs from footings to the bottom of the crossarm. Welded mild-steel plate is used for the shoes, leg tops, and caps, all galvanized after fabrication. These are steel largely because time did not permit experimentation with aluminum members.

Tower legs are made of tubular sections whose strength corresponds with requirements based on tower height, conductor pull, span, and snow-on-ground conditions. Standard section length is 12 ft 4½ in., and standard half sections 6 ft 4½ in. Footings at different elevations necessitated half-sections and odd-length top-closure sections. Half-sections occasionally permit a reasonable length for top-closure sections. Seven thicknesses of aluminum sheet were used for section fabrication. Joint rings of alloy aluminum extrusions reinforce section ends and are riveted to the leg shell, their flanges joining sections through 33 sets of aluminum clamps and 33 high-tensile steel bolts per circumferential joint.

Legs are fixed to foundations with anchor bolts through all-welded tubular galvanized mild-steel shoes with a 38-in. overall dia. The shoes transfer to foundations compressive and tensile forces and moments from secondary loads. At least four high-tensile-steel, 2-in. net dia. anchor bolts are used for each shoe. Eight anchor bolts, four in the outer corners of the base plate and four inside the shoe, give a rational bolt distribution for various stress magnitudes and the direction of the snow-creep thrust. Shoes are made from both ¼-in. and ⅜-in. plate, ⅞-in. base plates being used with both types.

A 15x17-in. oval manhole in each shoe gives access to the leg for tower erection, inspection, and maintenance, and the top leg is reached by a lightweight aluminum ladder. Entry under deep-snow conditions is provided by a 25x17.5-in. manhole in the second section of the diagonal leg. Manholes are reinforced and fitted with hinged covers.

**Top Pieces and Caps . . .** Each leg has a top-piece of welded mild-steel plate of either ⅞-in. or ¼-in. thickness. Bolted




## Savings Over Steel Towers, and Aluminum Towers Prove Better for Heavy Snow, Ice, Rime

together, the top-pieces form rigid heads for the A-frame and tripod. Side plates of the heads have a contour affording a smooth extension of leg sections. The diagonal-leg top-piece, however, has flat side plates, reinforced with welded stiffeners, to provide a simple-plane bolting face with the tops of the paired legs in the tripod.

Caps are bolted to the heads of the tower by eight steel bolts, supplemented by others on the bottom's perimeter. The box-girder crossarm is supported at two points just below the web plates by the caps. This vertical support permits relatively free vertical or horizontal movement of the crossarm and avoids transferring bending moments to the legs. Pins in the crossarm center line resist horizontal thrust of unbalanced conductor pull under the specified crossarm loads.

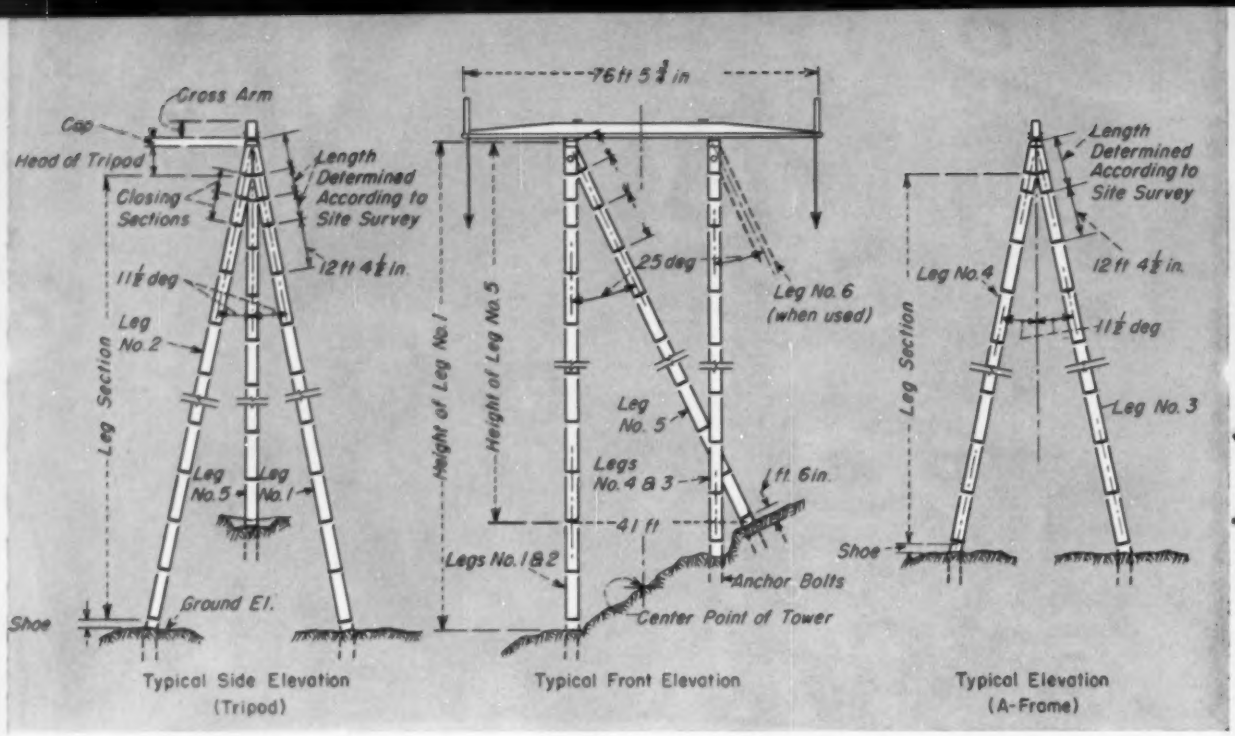
**Crossarms . . .** Four types of crossarms provide proper clearance between conductors and between conductors and structure under maximum line-angle conditions. Of two types of angle-strain tower crossarms, one is for light and a longer one for heavy angles. Suspension tower crossarms differ in strength rather than length.

The crossarm is simply a supported beam with the middle-phase conductor suspended at or near the center line. Actual point of suspension is governed by clearance between conductor and diagonal leg. The crossarm, with outer-phase conductors supported on cantilevered ends, has a constant width between web plates of about 26 in. The part between caps is about 48-in. deep, and the upper flange drops down from the caps towards the ends where the depth is 24 in. Crossarms are dimensioned to take care of a conductor breaking.

Crossarms are riveted aluminum structures, only the stiffeners added to the webs and bottom plates being welded. Crossarm web plates are ⅞-in. thick, but the heavy suspension crossarms are ¼ in. Special suspension yokes for insulator assemblies eliminate eccentricity of vertical loads. Crossarms are sectionalized for easy transportation. Each section is limited to 22 ft and 1,700 lb. Angle-strain and suspension tower crossarms were fabricated in three or four sections, and splices were bolted in the field.

**Shoes Bolt to Concrete Pads . . .** About 60% of the towers are on sound rock, only minor excavation and concreting for leveling of the shoe base being needed. Towers on loose, disintegrated rock (detritus) have reinforced concrete foundations. Where footings are rock, weathered surface rock was stripped at each shoe to sound rock. Holes of 3½-in. dia. were diamond drilled for anchor bolts which were grouted in the holes. Shoes rest on the concrete pad. Bolts were tightened with steel wedges or shims under all corners of the bottom plate reinforcement. Small vertical adjustments were made with steel wedges, shims, or by adjusting anchor bolt nuts.

Aluminum ladders inside the legs give access to joints and tops of the legs. Ladder sections are carried by brackets fastened by bolts in the joint ring. Ladders were attached during erection of the legs. Manhole covers in the tops of legs No. 1 and 4 serve as platforms when opened and have safety rails. From these platforms, a permanent aluminum ladder leads to the crossarm and its top manholes. A temporary guardrail may be rigged on top of the crossarm by using special sockets for stanchions or




uprights. U-bolts and safety handgrips aid in stringing and servicing the line.

Of the two types of insulator-assembly suspension yokes used, one was designed for the angle-strain and the other for the suspension crossarm. Both provide an essentially torque-free application of conductor loads to crossarms at any line angle. These forged and welded steel yokes are bolted at the cross-section center line of the crossarm. U-bolts for suspending the jumper insulator strings are fixed to the bottom of the crossarm close to the suspension point of the yokes.

**Climbing Ginpole . . .** Field erection was facilitated by the relatively few elements per tower and the light weight of aluminum sections and pieces. Primary equipment was a winch-operated, 28.5-ft-long "climbing" ginpole and ladder operated by a two-man crew. The ginpole was an all-welded aluminum beam, made from ⅜-in. aluminum sheet, in a 4x6-in. box section for stiffness. An outrigger about 3-ft long bolts to the ginpole's upper end.

Two steel hoop clamps hold ginpole against tower leg. Two wedges secure the ginpole laterally, and a keeper supports it against the rim of the joint ring. For maximum safety, the lifting wire rope runs over the wheels on the outrigger and down through the hollow ginpole to the 5-ton-capacity hand winch fixed to the seat around the manhole in the tower shoe.

First and second leg sections were assembled on the ground. The ginpole was fixed with the hoop clamps to these sections, with the upper end cantilevering. Sections with attached ginpole were raised for bolting to the shoe by another ginpole on the ground and guyed to the anchor bolts of the shoe. Third and following sections were raised by the ginpole. When a section had been lifted and bolted, the ginpole was freed from the hoop clamps, and the wedges and keeper removed. The ginpole, pulled by the winch and wire rope, then "climbed" to the newly raised section. Hoop clamps were attached, and wedges and keeper positioned to ready the ginpole for lifting the next section.

Finally, the top-piece was hoisted with a temporary davit bolted to it. With the A-frame and tripod assembled, davits on the leg heads lifted the crossarm which was pulled up with the winch line running over the davit sheaves down to the hand winches on legs No. 1 and 4. The crossarm rode along the legs on two rubber-wheeled dollies fixed to it. At the top of the lift, dolly wheels ran over a temporary clearance runner covering the caps. These runners were removed after the crossarm had been suspended from both davits. The crossarm was then lowered onto the caps.

**Loading Factors . . .** Aluminum towers were designed for unusually heavy loading specifications, three factors predominating:

1. Climatic conditions because of the influence of mountains on warm, moisture-laden air masses from the ocean.

2. High current-carrying-capacity conductors necessary, coupled with heavy electrical loading dictated by limited number of circuits.

3. Heavy deflection angles and long spans in the line because of the rugged terrain.

Before the tower design was finalized, an experimental span of 795-MCM ACSR was erected between two 26-ft aluminum towers at 5,300-ft elevation in Kildala Pass. Observations revealed a maximum ice loading of 2.4 lb/lin ft during the1950-51 winter. High current-carrying capacity required in conductors dictated an ACSR conductor with a 2.295-in. OD, weighing 4.77 lb/ft, an ulti-

## Vital Statistics of the 300-Kv Aluminum Tower Line

**Tower Geometry**

Strain towers
- Maximum insulator swing 30 deg
- Length of insulator string
  - Line angles to 22 deg 11 ft
  - Line angles to 45 deg 12 ft

Suspension towers
- Maximum insulator swing 36 deg
- Length of insulator string 13 ft, 7.5 in.

Both Types
- Minimum conductor spacing 30 ft
- Clearance at point of maximum swing 7 ft, 9 in.
- Intersection angles of tower members:
  - Between pairs 23 deg (1 and 2; 3 and 4)
  - Between 5 and 1, 2 25 deg

**Crossarm Lengths**

Suspension towers 76 ft, 5¾ in.

Strain towers
- Light-angle 65 ft, 4 in.
- Heavy-angle 67 ft, 8 in.

**Tower Heights**

| Number of Towers in this Height Range | |
|---|---|
| 8 | 128-139.5 ft |
| 13 | 113-125 ft |
| 9 | 91-111 ft |
| 5 | 74- 89 ft |

**Span Lengths**

| Number of Spans in this Length Range | |
|---|---|
| 5 | 2,000-2,592 ft |
| 7 | 1,500-2,000 ft |
| 13 | 1,000-1,500 ft |
| 9 | 634-1,000 ft |

**Length of Line** 9 miles

**Conductor** 108/37, 3,364 MCM ACSR (2.295 in. overall diameter)

mate strength of 135,700 lb, and an aluminum cross-section of 3,364 MCM.

**Principal Load Requirements . . .** Loading specifications embraced these requirements as to principal loads:

**A loads**—Ice load at 40 lb/ft of conductor at 0 F. Horizontal component of conductor tension is 120,000 lb maximum. This may be described as a yield-point load.

**B loads**—2.5-in. radial ice deposit on the conductor. Horizontal component of conductor tension is 65,000 lb. Horizontal pull normal to the crossarm (P) is 10,000 lb at each point of conductor support.

**B'** loads—60% of B loads, except P, is 45,000 lb at each point of conductor support.

**C loads**—2.0-in. radial deposit of rime on the conductor combined with wind of 8 psf. Horizontal component of conductor tension is 35,000 lb. P is 10,000 lb at each point of conductor support.

**D loads**—¾-in. radial deposit of ice combined with wind at 11 psf and broken conductor. Horizontal component of conductor tension is 31,000 lb. At the suspension towers, P is 22,500 lb at any one point of conductor support. At the strain towers, P is 25,000 lb at any one point of conductor support.

Specific gravity of ice was figured at 0.90 and of rime at 0.30. Weight of insulators and hardware was taken at 3,700 lb for strain towers and 1,000 lb for suspension towers. For wind loads in conjunction with C and D loads on towers, 2,000 lb per point of conductor support was assumed.

**Additional Secondary Loads . . .** Aluminum towers were designed to the same general loading specifications as the steel single-circuit towers, with these additional secondary loads:

Dead weight of tower legs and crossarm.

Wind load at 20 psf on circular surfaces and 40 psf on flat surfaces. Wind loads are taken in the direction of P and T loads.

Snow loads corresponding to a loading of 6 in. of ice on all surfaces including legs and snow-creep pressures on legs under three categories:

1. Normal load of 33,000 lb in 20-ft snow, with ground slope of 20 deg.
2. Light overload of 49,500 lb in 20-ft snow, with ground slope of 40 deg.
3. Heavy overload of 66,000 lb in 20-ft snow, with ground slope of greater than 40 deg.

With snow loads, the 6 in. of ice was assumed to act simultaneously with snow-creep pressures.

A 100-ft test tower in the Yarrows, Ltd, shipyard, Victoria, established the feasibility of the design.

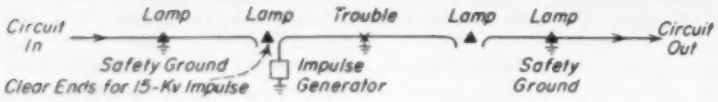
**Tower Weight . . .** Average weight of the 35 aluminum towers is only 25.8 tons, the lightest 16.5 and the heaviest 33.5 tons. Average weight of single-circuit steel towers for the same general conditions is 42.6 tons. These relative weights refer to towers of different heights and strengths despite identical basic loading conditions. Aluminum strain towers are designed to withstand P loads of 45,000 lb; the corresponding steel towers only 25,000 lb. As aluminum tower weights include 4.2 to 5.3 tons of steel, such tonnage must be deducted from both weights in determining the efficiency of aluminum.

A 114-ft aluminum tower has 110 major components and requires some 2,220 bolts (bagged or boxed), mostly with clamps. An equivalent steel tower of the same height has 1,120 steel members and needs 4,740 bolts and washers.

**Shipping and Erection Costs . . .** Transportation costs less for the average lighter aluminum tower, and its fewer components facilitate distribution to sites with fewer pieces lost. Compared with steel towers, aluminum towers produce substantial savings through simplicity of design, substantially smaller tonnage to be erected, adaptability to erection by simple low-weight equipment, and confidence of workmen when maximum safe working conditions are built into the design.

Men cannot accomplish the same output at high altitudes as at sea level; so the lighter aluminum tower produces important savings in erection costs. Erection of

(*Continued on page* 188)




**PATROLLING CABLE** is done by a trouble-man with a stethoscope comprising a probe with a microphone (in right hand), an amplifier (in left hand), and ear phones (on his head)

# Ground Vibrations Pin Point Faults

**C. B. BECHTEL**, Assistant Engineer, Electric Distribution Dept, Consolidated Gas, Electric Light & Power Co, Baltimore, Md.

A ground vibration method, supplemented by a "sheath drop" method, pin points faults in buried cable used for series street lighting. Consolidated Gas, Electric Light & Power Co has found these methods reduce costs 50%. Moreover, troubles can be located without digging up much of the cable, which is No. 8, 5-kv, single conductor, rubber insulated, lead covered, and plowed 18 in. deep.

The ground vibration method is applicable to all faults having a shunt resistance which can be made to rise to high values. It involves the application of relatively high-voltage impulses to a faulted section and detection of the ground vibration caused by periodic discharge of energy through the fault.

To detect vibration, a special "stethoscope" was constructed by mounting a contact microphone on the end of a probe and connecting it through a three-stage audio amplifier to a headset. The system is designed for optimum response to frequencies ranging from 30 to 1,500 cps. Commercially available medical stethoscopes, incorporating electronic amplification, have also been used and are equally effective.

Shielding against inductive pickup has not been necessary but could be provided by a metal case around the amplifier. Capacity of such a case to ground eliminates a ground wire.

In operation, the faulted section is located by using an ohmmeter. Then the section is isolated at lamps on either end, and adjacent lamps are grounded to protect against voltage surges on the remainder of the circuit.

The 15-kv impulse generator is then connected to the faulted section, as shown above, and energized. The section is then patrolled with the stethoscope to pin point the fault.

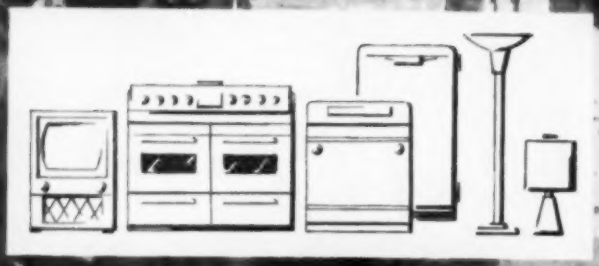
Magnitude of the vibration over a fault varies directly with the fault resistance to ground. While the initial fault resistance, measured by a 1.5-v ohmmeter, is generally in the order of ohms, it normally rises to 10,000 ohms or more within the first minute of operation of the impulse generator. This is a result of the impulse energy blasting carbonized in-

(*Continued on page* 187)

General Electric Announces...
GENERAL ELECTRIC
SINGLE-PHASE WATTHOUR METER
TYPE I-55-S
KILOWATTHOURS
15 AMPERES
240 VOLTS
3 WIRE
Kh 3.6
60 CYCLES
Kh 27½
MODEL AR1
•34 904 235
MADE IN U.S.A.
Newest member of the I-50 Meter Family...

# 1955

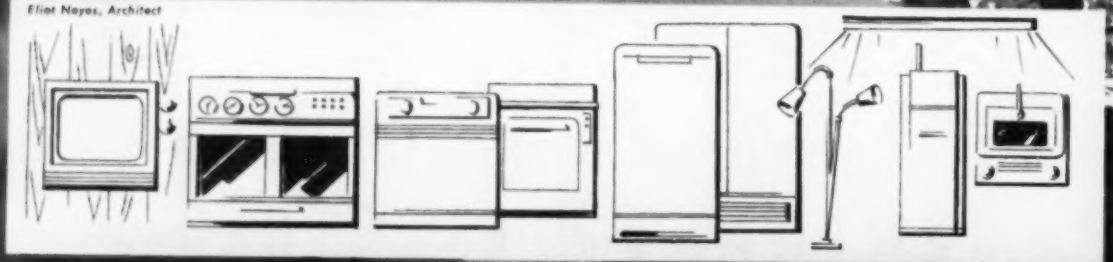
Present-day meters handle residential loads ranging up to 30-40 amperes. In next ten years, this will be greatly increased.



# 1965

Loads will more than double. New appliances will necessitate new meters like the G-E I-55 meter, capable of measuring up to 100 amps.

*Eliot Noyes, Architect*



# **NEW** General Electric I-55 Watthour Meter Offers Straight-line Accuracy up to 100 Amps

### New meter, designed for future loads, retains all the features of the proven I-50 meter family

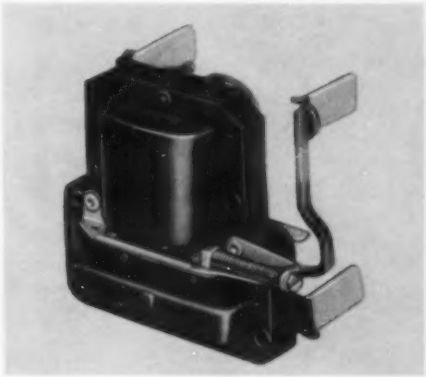
General Electric's newest addition to the I-50 meter family, the 15-ampere I-55 watthour meter, combines straight-line accuracy up to 100 amps with all of the proven features inherent in each I-50 design.

Designed for the increasing loads of the future, the new I-55 meter is *factory certified* for accuracy and performance . . . offering you the same dependability and savings so long associated with the original I-50 meter.

All of the outstanding qualities of the established I-50 family have been retained in the new G-E meter: rigid unit construction of all parts, magnetic suspension of the rotor, unique retarding system, highly legible registers. These cost-saving features have been proven by the more than five million I-50 meters in service today. For more information on the new I-55 meter, write for the new descriptive bulletin "G-E I-50 Meter Family," GEA-6071 to: Section 621-1, General Electric Company, Schenectady 5, N. Y.

## I-50 METER FAMILY . . . DESIGNED TO LOWER YOUR METERING COSTS

**MAGNETIC SUSPENSION** system eliminates bearing wear, keeps maintenance cost to a minimum.



**UNIQUE STATOR DESIGN** of unit construction eliminates any changes in calibration. Butyl-molded current coil assures accurate, reliable operation.

**INCREASED LEGIBILITY** is assured in both the low-friction cyclometer and pointer-type registers.

*Progress Is Our Most Important Product*

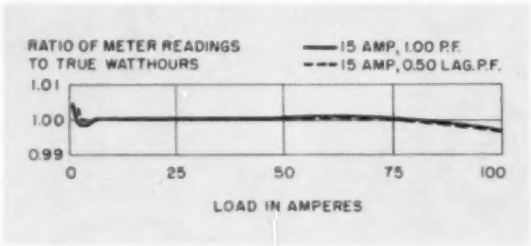
GENERAL ELECTRIC

# New G-E I-55 Watthour Meter...

## STRAIGHT-LINE ACCURACY UP TO 100 AMPS

Capable of accurately measuring loads up to 100 amperes, the new G-E meter has been designed to accommodate the projected doubling of loads in the next ten years.

With this straight-line accuracy, the I-55 meter offers greater versatility, longer life, more economical operation.




## FACTORY CERTIFIED FOR ACCURACY AND PERFORMANCE

The new I-55 meters offer *certified* accuracy and *certified* performance.

The gold seal of certification is your assurance that each General Electric I-55 meter has met the rigid, quality-control standards and is factory certified . . . your key to lower metering costs.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# New Records Show Voltage Trends Requiring Action

**S. P. WOOLFORD**, Senior Engineer, System Production Dept, Virginia Electric & Power Co, Richmond, Va.

Voltage recurrence records developed by Virginia Electric & Power Co show voltage trends at key points in the service area. They provide, at minimum expense, a yearly record of important voltage data for each point on a separate single sheet. Serious conditions can be easily detected before they occur.

Maximum and minimum voltages and percent regulation for each seven-day period during a year are recorded in a graphical manner on 8½ x 11-in. sheets. Short-time voltage disturbances can be quickly distinguished on the record from continually recurring conditions that need attention. A time element for upper and lower voltages is added to complete the qualitative description.

Preparation of the voltage recurrence record from a graphic voltmeter chart is a routine task for an average clerk after a few minutes instruction. Proficiency quickly reaches the point where data for each record can be extracted from a seven-day chart in less than 15 min.

Mechanics of preparing the record from a properly identified and dated chart are:

**1.** Observe and record, to the nearest volt, the highest voltage during the week, the time and date when it first occurred, and the number of half-hour time divisions during which it occurred.

**2.** For each two-volt scalar division below the maximum voltage, count and record the number of half-hour divisions that the voltage is equal to or more than that scalar division until the count is ten or more.

**3.** Observe and record the lowest voltage, the time and date when it first occurred, and the number of half-hour time divisions during which the minimum voltage occurred.

**4.** For each two-volt scalar division above the minimum voltage, count and record the number of half-hour divisions that the voltage is equal to or lower than that scalar division until the count is ten or more.

**5.** Plot the data on the voltage recurrence record. (A complete example of the procedure is shown in Fig 1.)

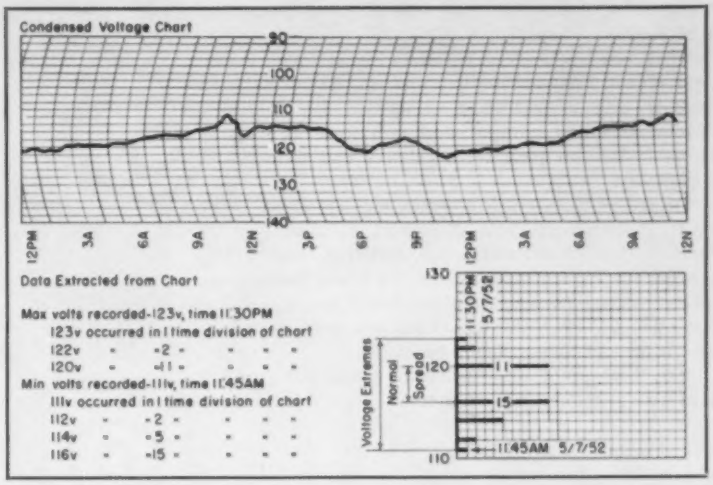



FIG 1—PROCEDURE FOR PLOTTING data that are taken from recording voltmeter chart is illustrated. An average clerk can extract data from a 7-day chart in less than 15 min

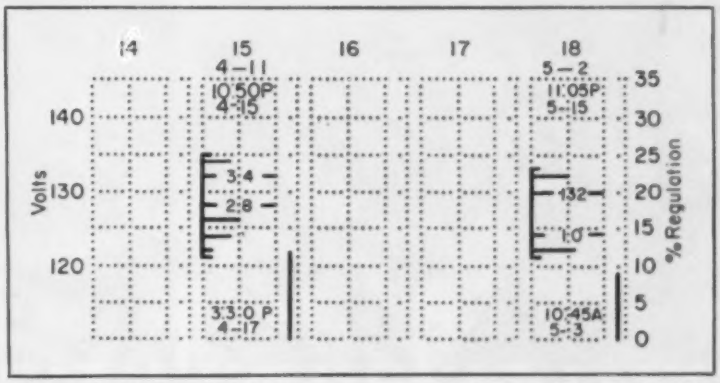



FIG 2—VOLTAGE RECURRENCE RECORD has four rows of 13 weekly "box" units, of which only five units are shown. Percent regulation is vertically plotted to right of individual boxes. Dots are used as scale, rather than ruled lines, to avoid congestion and confusion

Experience during 1954 indicates that only maximum and minimum voltages need be plotted when the spread is 6 volts or less. This reduces the cost of making records without detracting from their usefulness. In 1955, records will be kept for about 90 key check points.

Vepco uses transparent paper for the record forms, so that economy of duplication is achieved. The original record for each key point is kept in the district office directing distribution work. At one month intervals a new print from each record is sent to the System Production Department where the latest prints for all check points are kept.

# Light Steel Substation Costs About $1,000

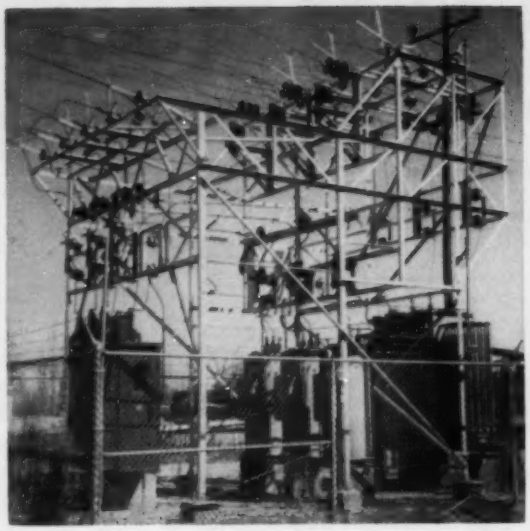
ROY M. WALKER, Asst General Engineer, El Paso Electric Co, Texas

Light steel structure for 1,500-kva substations has been designed by El Paso Electric Co for an erected cost of a little over $1,000. This includes cost of concrete foundations for structure, transformer, regulators and breakers. About ten structures are in use in areas where appearance is of secondary importance.

Angle iron is fabricated locally for about $500. Before erection it is given coats of red lead and aluminum paint. Another coat of aluminum is applied after erection. Channel iron and salvaged steel rails serve as supports across foundation piers for regulators and transformer, respectively.

Situated on plots which generally measure about 24 by 30 ft, the structures hold disconnect switches, primary fuses, current transformers for metering, and bypass switches for breaker maintenance. On newer installations, cables running to and from regulators are encased in mineral fiber ducts. Structures of this type are used on both 24-4.16-kv and 13.8-4.16-kv substations.

With this type of construction the power company has been able to reduce substation costs.



ANGLE IRON STRUCTURE and concrete foundations for 1,500-kva, 24/4.16-kv or 13.8/4.16-kv subs cost only a little over $1,000 erected

EXPOSED FOR REPAIRS and modifications, baffles and apron show signs of erosion. Engineers consider damage slight for 15 years wear

UPSTREAM BAFFLES show 6 to 12 in. of erosion. They will be capped with a 12-in. concrete shell anchored with No. 8 reinforcing bars

# Spillway and Baffles Restored at Bonneville Hydro Plant

Bonneville Dam spillway baffles, recently exposed for repairs and modifications, have held up beyond Army Corps of Engineers expectations. This is the first time since completion of the dam in 1939 that the two rows of baffles on the apron below eight spillway gates on the Oregon side of the dam have been exposed. Most erosion was found along the 500-ft apron, but Corps hydraulic engineers consider the damage slight after 15 years of spillage.

Baffles show erosion of from 6 to 12 in. Allowing for this, 6 in. will be cut off sides and tops of all upstream baffles. They then will be capped with a 12-in.-thick concrete shell which will be anchored with No. 8 reinforcing bars grouted 2 ft into the concrete. The resulting baffle will be 6 in. wider and higher than the existing blocks.

Downstream baffles will be connected into a solid wall barrier. No. 8 reinforcing bars will anchor the concrete. The solid downstream barrier was a design debated during the original construction but was not undertaken at that time. Corps hydraulics laboratory studies and experience

(*Continued on page* 124)

# NEXT: GASEOUS INSULATION

An entirely new concept—*gas* as a power transformer insulation and coolant—is now being used by General Electric engineers at Pittsfield, Mass. The gas is sulphur hexafluoride chosen because of its high dielectric strength.

Lighter, quieter, safer . . . these are the predictions for this revolutionary design, a joint project of G.E. and the Consolidated Edison Company of New York. Above is a model of the 2000-kva, 69-kv units now being built.

Gas-insulated transformers will be *safer* because sulphur hexafluoride is non-flammable; *quieter*—because pressurized gas conducts sound far less readily than liquid; *lighter and more compact*—because the gas will eliminate heavy liquid insulation. General Electric Company, Schenectady 5, N.Y.

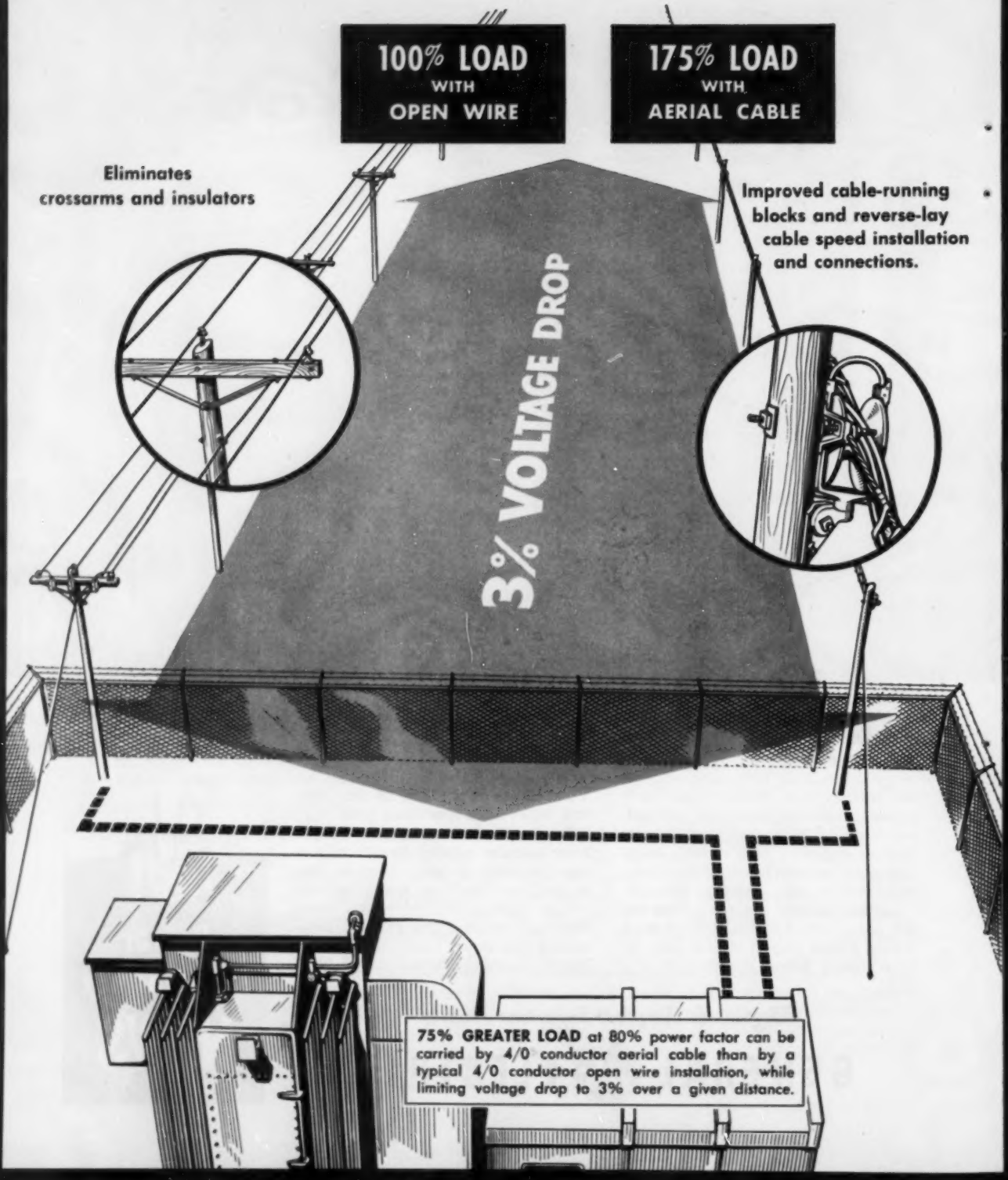
421-27

**Power Transformer NEWS**

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

# Greater Load-carrying Ability Proves


100% LOAD WITH OPEN WIRE
175% LOAD WITH AERIAL CABLE
Eliminates crossarms and insulators
Improved cable-running blocks and reverse-lay cable speed installation and connections.
3% VOLTAGE DROP
75% GREATER LOAD at 80% power factor can be carried by 4/0 conductor aerial cable than by a typical 4/0 conductor open wire installation, while limiting voltage drop to 3% over a given distance.

# Economy of Aerial Cable Feeders

## Continuing improvements in installation techniques indicate further reductions in cost

Because of its lower reactance, General Electric Super Coronol* preassembled aerial cable can carry far more load within a permissible voltage drop than open wire of the same size. Thus, if you evaluate cost on the more realistic basis of dollars per kva of load instead of cost per mile of line, the initial cost of aerial cable is actually only 3 to 12% more than open wire. (See comparative graphs.)

**You also receive these extra benefits:**

### BETTER APPEARANCE

Crossarms, insulators, and unsightly open wire lines are eliminated.

### LOWER MAINTENANCE COSTS

Fewer storm damage repairs, less tree trimming, no insulation festooning.

### FEWER OUTAGE REVENUE LOSSES

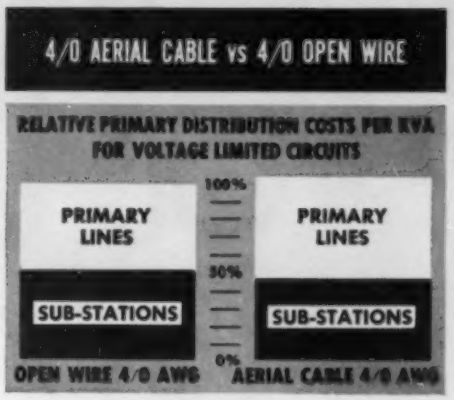
Greater reliability—because messenger-supported cables are far less vulnerable to damage by elements and falling trees—reduces feeder outages and resulting loss of revenue. Better service continuity improves customer relations.

### INCREASED LOADS

Greater loads can be carried on voltage-limited 4160-volt feeders, up to a load density of 7500 kva per square mile, because of the combination of the low reactance and 85 C copper temperature of G-E Super Coronol preassembled aerial cable.

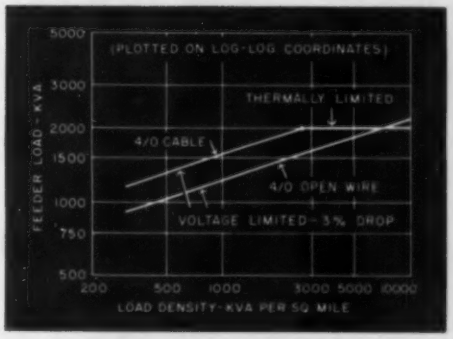
For additional facts send for "Economic Performance of Aerial Cable for Distribution Systems." Address Section W154-227, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company*



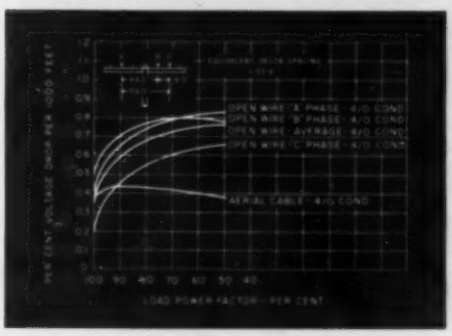

**COST**

Comparative primary distribution costs per kva for voltage limited circuits




**FEEDER LOADING**

Load density characteristics of 4160-volt feeders with 3% voltage drop limitation


OPEN WIRE A PHASE - 4/0 COND
OPEN WIRE B PHASE - 4/0 COND
OPEN WIRE AVERAGE - 4/0 COND
OPEN WIRE C PHASE - 4/0 COND
AERIAL CABLE - 4/0 COND
PER CENT VOLTAGE DROP PER 1000 FEET
100 90 80 70 60 50 40
LOAD POWER FACTOR - PER CENT

**VOLTAGE DROP**

Voltage regulation per 1000 feet 4.16 kv feeders, 1000 kva base, 3 phase

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

## Bonneville Baffles and Spillway Repairs

(*Continued from page* 120)

**EROSION OF APRON** and sill behind upstream baffles will be reduced by filling in downstream baffles to form solid wall barrier

**MOST SEVERE EROSION** was on piers and spillways used, though unfinished, when river was diverted during work on Washington side

elsewhere now indicate the solid end sill construction will reduce cavitation on the downstream apron floor and sill. It also will help produce desired water action in the stilling basin.

Spillways, constructed originally to the height of visible surface erosion on Bay 14 show the most severe erosion and cavitation damage. They were subjected to considerable scouring action when the river was diverted through the unfinished bays while the Washington side was under construction. When the river was diverted again through the completed north bays, it was necessary to resurface the south spillways, piers, and apron. This was gunited behind the steel cofferdam which was supported by and anchored to the trunnion castings visible in spillway. The upper spillway portion then was poured on these bays, but the thin surface has broken away from the gunited lower section.

Trunnion castings will be lifted during restoration and gunite repair made on pier and spillway surfaces. A new apron of 12-in.-thick concrete also will be poured.

# Modern Facilities Test Constant Current Transformers

**M. A. FREDRICKSON,** Test Superintendent Shop and Test Div, Southern California Edison Co, Alhambra, Calif.

Modern test facilities for handling constant-current transformers up to 30 kva were designed by Southern California Edison Co to meet these objectives:

**1.** Remote-control testing from a convenient console-type test bench that has controls on the front panel.

**2.** Simplified metering and low values of current and voltage in test bench circuits through multi-range precision instrument transformations.

**3.** Maximum safety through use of electrical interlocks, safety platform, warning lights, and test floor barriers.

The console bench that helps meet these objectives consists of a standard steel office desk. Added to the desk was a special top section with an aluminum frame and formica top. The special top raises instruments to a better level for reading and provides a compartment for components and controls. Desk drawer space is convenient for storage.

Test source for constant-current transformers is supplied through a 50-amp, 2.4-kv induction regulator with ±10% rating. An intermediate transition to 480 v to permit operation of a magnetic contactor and a visual disconnect switch at lower voltages is made through two 50-kva, 2,400/480-v transformers. Input metering for

**TESTING CENTER** is a steel desk fitted with special top having control front. This panel controls supply and load sources remotely

the 2.4-kv supply to the unit under test is handled through a potential transformer and two current-transformer ranges of 25:5 and 5:5.

Constant-current transformer under test is loaded through an adjustable lamp and non-inductive resistor bank. The motor-driven contactor through which load is continuously variable from the test bench has proved

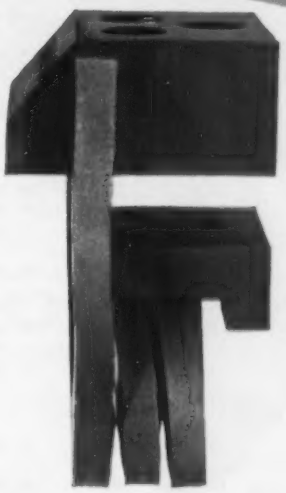
(*Continued on page* 130)

I-T-E

## SAVES MONEY BY USING

# Revere Extruded Shapes

## PROBABLY YOU CAN TOO!



Actuating mechanism, showing overload coil brazed to two Revere Extruded Shapes.

Overload device, OD-2, made by I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia, Pa., using Revere Copper Extruded Shapes.

Here is a photograph of the I-T-E Dual Selective Overcurrent Trip, an air circuit breaker part. It contains two Revere Extruded Shapes, in copper. In the detail view, the beveled shape at the top is furnished in Free-Cutting Copper, to speed up the drilling and tapping of the holes. The piece below it was originally milled from rectangular copper bar, 1 x 2 inches. The bar weighed 7¾ lbs per foot, and 1.8 lb of scrap per foot was generated in machining it to the angular form shown. The company then switched to a Revere Extruded Shape, weighing a little less than 6 lbs per foot. Though the shape inevitably costs more per pound than the bar, the reduction in weight was sufficient to save almost 44¢ per foot over the bar, and of course additional savings were realized in reduced machining time and in scrap handling. Production also was speeded up. This is an outstanding example of the economies offered by shapes.

Look into extruded shapes, in copper and copper-base alloys, and aluminum alloys. The nearest Revere Sales Office will be glad to explore the subject with you.

**REVERE**

**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

• • •

*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities; Distributors Everywhere.*

# Hints for Landscaping Unit Substations*

Landscaping is the prevalent method today of making distribution substations attractive and communally acceptable in the new suburbs mushrooming all over the country. Mass planting to create a naturalistic effect minimizes the industrial, man-made aspect of substations and is preferable to housing such units in an expensive building.

Some utilities have landscaped substation plots well in advance of installation. This helps to assure immediate concealment and consequently promotes neighborhood good will. A few large evergreens help with the immediate camouflage and other fast-growing shrubs completely hide the substation in a few years.

Masses of evergreens close to the fence or wall conceal the structure, but render obvious that something is hidden. Small trees or shrubs in front of the evergreens make the planting more artistic and the entire grouping less conspicuous. Hemlock, arborvitae, or other evergreens grow thick and blend with each other, and colorful trees, such as crab apple, dogwood, and paper birch, should supplement them. Hardy trees, requiring a minimum of maintenance, are best.

Landscaping should imitate nature by creating plantings with irregular gentle curves in front and an uneven skyline in back. An even skyline and a regular front call attention to the landscaping and defeat its purpose.

When the gate cannot be located on the side away from the street, a hedge may conceal it. Vines improve the appearance of a fence and attractively fill in empty spaces between shrubs and trees. Thus they cut down on more expensive plantings. A fast-growing vine with luxuriant foliage, such as English ivy, euonymus, or star jasmine, is usually an excellent choice.

Although rather expensive, privet hedge is attractive and effective for screening a substation near the street. Often it is practicable to plant the hedge on top of a gently graded hill around the substation. Hemlock and yews are also fine selections, but boxwood grows too slowly.

A stockade or split-sapling fence is generally less expensive than shrubbery giving the same concealment and requires practically no maintenance since the wood is more attractive when allowed to weather naturally, with the bark removed. Where necessary, it can be topped with barbed wire. Corrugated asbestos is an economical substitute.

A 4-ft-high sloping earth bank on three sides of the substation, with evergreen trees on top of the slope, effectively screens steel structure where wires cannot be kept underground. Small shrubs between the trees break up the screen effect, and flowering trees at the bottom of the bank complete the picturesque appearance.

Brick or stone walls, although expensive, are sometimes worth while. A brick wall is especially suited to disguising a substation between commercial buildings, and with an attractive wooden gate preserves the appearance of a commercial area.

*Based on advance sheets of a General Electric Co publication now ready for release.

## Typical Landscaping Suggestions

(For Various Regions in United States)

| No. | Variety | Size[1], ft | Unit Cost[2], $ | Total Cost[2], $ |
|---|---|---|---|---|
| | **North** | | | |
| 1 | Chinese Elm | 12–14 | 25.00 | 25.00 |
| 20 | Hemlock | 3 | 7.50 | 150.00 |
| 1 | Douglas Fir | 12–14 | 48.00 | 48.00 |
| 5 | White Birch | 10–12 | 5.00 | 25.00 |
| 40 | Winter Creeper | ..... | 2.25 | 90.00 |
| 6 | Red Cedar | 7–8 | 12.50 | 75.00 |
| | | | TOTAL | 413.00 |
| | **East and Midwest** | | | |
| 4 | Dogwood | 8–9 | 25.00 | 100.00 |
| 34 | Arborvitae | 5 | 9.00 | 306.00 |
| 300 | Pachysandra (ground cover) | ..... | 7.50 per 100 | 22.50 |
| 1 | Ginkgo or Sugar Maple | 4–4½ (caliper) | 65.00 | 65.00 |
| 1 | Purple Leaf Plum | 8–10 | 7.50 | 7.50 |
| 1 | Norway Spruce | 9–10 | 50.00 | 50.00 |
| | | | TOTAL | 551.00 |
| | **Far West** | | | |
| 10 | Arbutus Unedo (5 gal can[3]) | 2–3 | 3.50 | 35.00 |
| 1 | Olive (2 ft box[3]) | 12–14 | 60.00 | 60.00 |
| 5 | Australian Flax (5 gal[3]) | 2–3 | 3.50 | 17.50 |
| 1 | Round Leaved Eucalyptus (5 gal[3]) | 5–6 | 3.50 | 3.50 |
| 12 | Laurel Sumac (5 gal[3]) | 2–3 | 3.50 | 42.00 |
| 10 | Blue Sage (1 gal[3]) | 1–1.5 | 1.25 | 12.50 |
| 30 | Tobira Privet (5 gal[3]) | 1.5–2 | 3.50 | 105.00 |
| 1 | Live Oak (3 ft box[3]) | 10–12 | 125.00 | 125.00 |
| | | | TOTAL | 400.50 |
| | **South** | | | |
| 2 | Magnolia Grandiflora | 10–12 | 40.00 | 80.00 |
| 30 | Wax Privet | 4–5 full | 3.50 | 105.00 |
| 1 | Star Magnolia | 5–6 | 25.00 | 25.00 |
| 12 | Cherry Laurel | 8–10 | 7.50 | 90.00 |
| 4 | Crepe Myrtle | 5–6 | 3.50 | 14.00 |
| | | | TOTAL | 314.00 |

[1] If labeled "caliper" trunk diameter is given. Otherwise figures indicate height.

[2] Costs are given only as rough guide in making selections. An effort was made to quote general price that exists in section of country indicated. Local conditions may cause deviation.

[3] Many Western states specify plants by reference to size of container that holds roots during early period of growth.

# America's Finest Suspensions...

# THANKS TO VICTOR "KNOW-HOW"

# and Purified Porcelain!

VICTOR No. 900
SUSPENSION

**SPECIFICATIONS**

| | |
|---|---|
| Type.....ball socket | Leakage Distance.....11½" |
| 60 cycle Dry Flashover.....80 KV | M and E Strength.....15,000 lbs. |
| 60 cycle Wet Flashover.....50 KV | Impact Rating.....55 lbs. |
| Pos. Impulse Flashover*.....125 KV | RIN.....50 Microvolts |
| Neg. Impulse Flashover*.....130 KV | 1000 KC at applied.....10 KV |
| Dry Arcing Distance.....7¾" | |

*Crest KV. 1½ x 40 microsecond wave Critical Value

Every VICTOR Suspension insulator is the result of sound design, superior craftsmanship and VICTOR *Purified* Porcelain—finest insulator porcelain ever made! That's why they have improved thermal resistance, better mechanical and electrical characteristics and greater resistance to impact. Thanks to VICTOR's unique "know-how," you just can't buy a better suspension!

For the full facts on Victor "Know-how," write for "The Story of Victor and Purified Porcelain." For engineering data on all Victor insulators, write for Bulletin No. 4.

**FEATURES**

1. Higher mechanical strength
2. Greater resistance to thermal variations
3. Unequalled uniformity of mechanical and electrical values
4. Unequalled resistance to impact
5. Specially compounded cement for maximum strength
6. Caps and pins scientifically designed to withstand pull far above NEMA specifications
7. All metal parts hot-dipped galvanized for maximum resistance to weathering and corrosion
8. Special "cushion" coatings at all joining surfaces

NEWS FROM VICTOR

Victor has more than doubled the area of its ceramic laboratory. The enlarged laboratory affords Victor better, more modern facilities for testing raw materials, controlling quality of production and carrying on basic ceramic research. It was made necessary by Victor's expanding research program now under way.

SPECIFY VICTOR

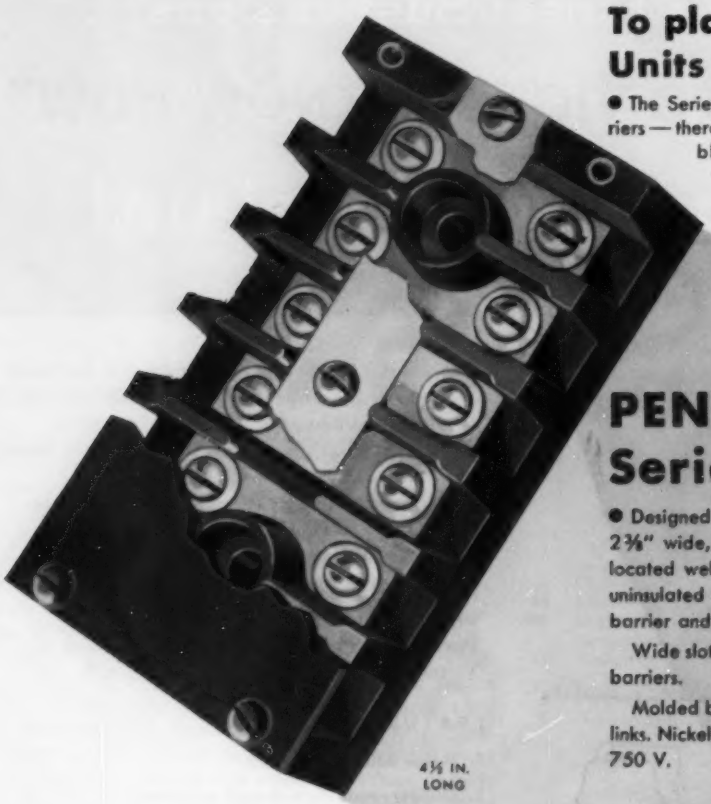
Purified Porcelain Suspensions!

VICTOR INSULATORS, INC., VICTOR, N. Y.
SUBSIDIARY OF I.T.E. CIRCUIT BREAKER CO.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

## To place More Units *Lengthwise*

● The Series 1000 has no extra-width end barriers — there are no wide gaps between adjacent block connections, so more units go lengthwise in the space available.



4½ IN. LONG

## PENN-UNION Series 1000

● Designed for space-economy lengthwise — but 2⅜" wide, permitting the binding screws to be located well away from the sides; less chance of uninsulated ends of wires projecting beyond the barrier and causing shorts.

Wide slot for making connections — ½" between barriers.

Molded black Bakelite base. Hard rolled copper links. Nickel-plated brass screws. Rating, 30 amp., 750 V.

3⅜ IN. LONG

## Popular Block for Appliances— PENN-UNION Series 3300

● Widely used for Electric Dryers, Washing Machines, Ranges, etc. Substantially made, fully up to standard Penn-Union specifications 60 Amp., 250 V.

2½ IN. LONG

## Small 4-wire for Appliances— PENN-UNION Series 5000

● A compact miniature of Series 1000, only ⅞-inch high and 1⅛-inch wide, rated 20 Amp., 500 V.

# PENN-UNION Terminal

## To place More Units *Sidewise*

● Nickel-plated brass screws and hard rolled copper links, standard on Penn-Union Terminal Blocks.

5⅛ IN. LONG

# PENN-UNION Series 6000

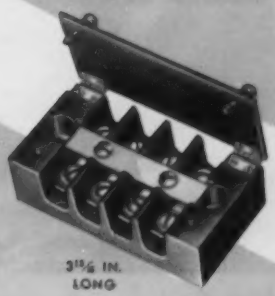
● Same wide slot as Series 1000, but 16% narrower—especially suitable when soldered or solderless lugs are to be used on the lead wires.

30 Amp., 750 V. The short-time current ratings can be increased by using additional jumper bars and longer screws.

Material specifications are same as Series 1000.



● Accurate alignment is assured by molding the brass inserts in the block, and tapping after molding.

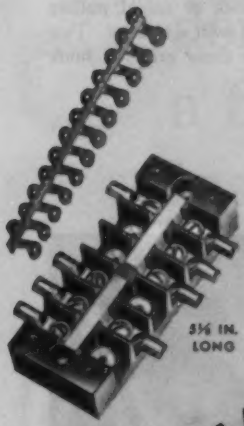


3¹⁵⁄₁₆ IN. LONG

## COVERS

● Bakelite or Asbestos — Hinged if desired.

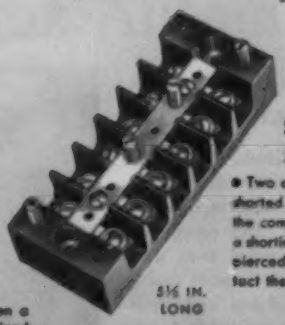
Holes are tapped at the corners of Penn-Union Series 6000 Blocks, for attaching a Bakelite or Ebony Asbestos cover, which can be furnished. 4 screws, or hinges with fastening knurled-head captive screws, or by spring clips for instant access.



5⅛ IN. LONG

## Multiple Circuit Jumper Bars

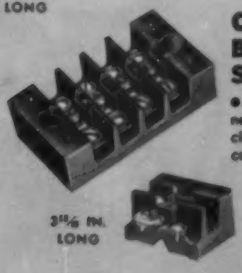
● To give any required branch circuits and tap-offs. Heavy rolled copper bar, in 12-circuit length, is cut to the circuits needed. At the right is shown one of the innumerable combinations that can be made.



5⅛ IN. LONG

## Short Circuiting Series 6000—SC

● Two or more of the circuits can be shorted whenever desired. In place of the composition marking strip, there's a shorting strip of hard rolled copper, pierced to take shorting pins to contact the jumper bar.



3¹⁵⁄₁₆ IN. LONG

## Circuit Breaking Series 6000—CB

● Very convenient when it's necessary to open and close circuits easily — for instance when a complex circuit must be sectionalized to locate trouble or make an adjustment.

The circuit-closing screws have machined shoulders—so that when in the open position they can't be turned and closed by vibration.

# Blocks

**PENN-UNION**

Penn-Union Electric Corporation • Erie, Pa.

☐ *Send sheets showing full line of Terminal Blocks.*

☐ *Send new Pocket Catalog — complete Penn-Union line.*

Name _____

Company _____

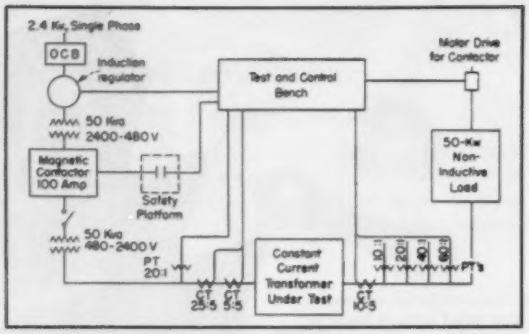
## Test Facilities

(*Continued from page* 124)

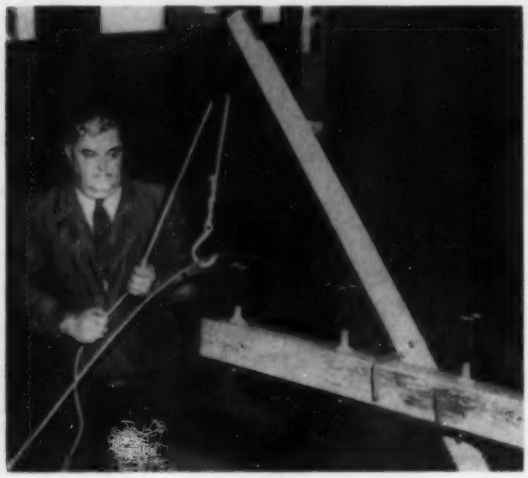
very desirable. Output metering is obtained through a 10:5-amp current transformer and four ranges of potential transformers. These ranges are 1,200, 2,400, 4,800 and 7,200:120 v.

Line and load-side test leads are supported from overhead terminals and easily reach any part of the test area without contacting the floor. Regulator, magnetic contactor, visual disconnect, loading device, and selection of instrument-transformer ratios are all conveniently controllable at the test bench.

Constant-current transformer losses from no-load to full load are determined easily. The conveniently adjustable loading permits a rapid determination of regulation over the entire operating range. Although 30-kva units are the largest currently tested, the installation has testing capacity up to 50 kva. Handling costs for equipment under test are cut through location of the test area adjacent to the shop and storage facilities. Modern industrial trucks also help to hold handling costs down.




**CONSTANT-CURRENT TESTS are made on transformers up to 30 kva with equipment shown. Maximum capacity is 50 kva for future use**



## Hoisting Wire Job Made Safer and Easier

Safe and fast method of hoisting wire into place on a cross arm is used by Jersey Central Power and Light Co. The device used does not require a lineman to lift the wire with his arm. This helps to prevent the possibility of back strains.

The device is about 5 ft long with a 4-in stock base tapering to a 2-in top. A small block or set of pulling blocks is attached to the narrow end with a bracket. Two "L" bolts secure the device to the cross arm. A hook on the block line carries the wire.

## Four-Reel Trailer Strings Conductors

A four-reel trailer saved Pacific Gas & Electric Co considerable time in stringing a three-conductor, all-aluminum line recently. This equipment permits such nice control over total and relative conductor tensions that it was possible to dead-end and tie-in directly without any sagging-in.

First use of the stringing trailer was made in stringing a 266,800-cir mil, all-aluminum 22-kv line at Pacific Grove, Calif. This rig will handle under tension four conductors up to size 366,000 cir mil ACSR or all-aluminum.

(*Continued on page* 133)

# don't give turbine room fires a fighting chance... install a Blaw-Knox Automatic Fire Protection System

Plant destruction . . . service interruption . . . customer complaints . . . loss of revenue . . . purchased power . . . uneconomical generation —these problems, emphasized by recent turbine room fires, demonstrate the need for effective fire protection.

Blaw-Knox engineers have recently completed studies of this need. They will design and install fully automatic fire protection systems to fill your specific needs . . . systems that will detect and extinguish such fires before they have a chance to spread beyond control.

Discuss your problem with a Blaw-Knox Fire Protection Engineer. Call him, or write us direct.

*"Little Joey Sprinkler" always on the job*

**BLAW-KNOX COMPANY**
*Power Piping & Sprinkler Division*
*Pittsburgh 33, Pennsylvania*

Imagine the wrath of this boy . . . and thousands of others in his community . . . if power outages cut off the TV at the "crucial moment". That's where C-D's field-proved dependability pays off . . . regardless of changing weather or power load conditions. The thousands of C-D power capacitor installations . . . all with records of better than 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.

# CORNELL-DUBILIER CAPACITORS

consistently dependable for power-factor improvement

PLANTS IN SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO

# CORNELL-DUBILIER
# power-factor capacitors give you better than 99.6% trouble-free service*

**Low dielectric unit stress provides an extra margin of safety that results in the ability to withstand higher transient voltages. When you buy C-D, you buy premium quality at no extra cost.**

**Extra strength wet process two piece porcelain terminals . . . one of the many important reasons why C-D capacitors can point to year after year of trouble-free service in coastal areas.**

**Another evidence of C-D's premium quality power capacitor service . . . at no extra cost . . . is the fact that C-D has no "Return Material Department". Most repairs are of such a minor nature that they are handled on an individual basis. This results in a prompt, personalized service impossible where the safety factor has been cut in favor of production, weight and size economies.**

**C-D's rack capacitors are shipped completely assembled ready for energization. Again C-D's conservative engineering standards provide the structural strength to do this and as a result save the utility time, assembly and installation costs in the field.**

***Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.***

**Part of a 27,000 KVAR C-D installation at substations of a large Western company.**

***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**


## Four-Reel Trailer

(*Continued from page* 130)

Proper tension is provided through four sets of 26-in. grooved drums of "bull" wheels, with two wheels per set for each conductor. Grooves are neoprene-lined to prevent injury to the conductor and to provide a positive grip. There are four wraps of conductor around each set of wheels, with vertical rubber rollers to guide the conductor on and off the wheels.

Braking of wheels is provided through a smooth-acting brake of the type used for emergency braking on heavy earth-moving equipment. A small flexible steel cable from each pair of brakes to a crank on the rig bed permits fine control.

Conductor reels are supported on their rims on four rubber-flanged rubber-tired wheels that ride on two shafts. Wheels adjust horizontally on the shafts to accommodate different reel widths. On each shaft a brake similar to the bull wheel unit provides braking to tension the conductor between the reel and the first bull wheel.

The stringing rig was used at Pacific Grove to keep conductors out of the underbuilt energized 4-kv and other circuits. As a precaution, the rig was grounded during the operation.

## Modified Pliers Open Automatic Splice Easily

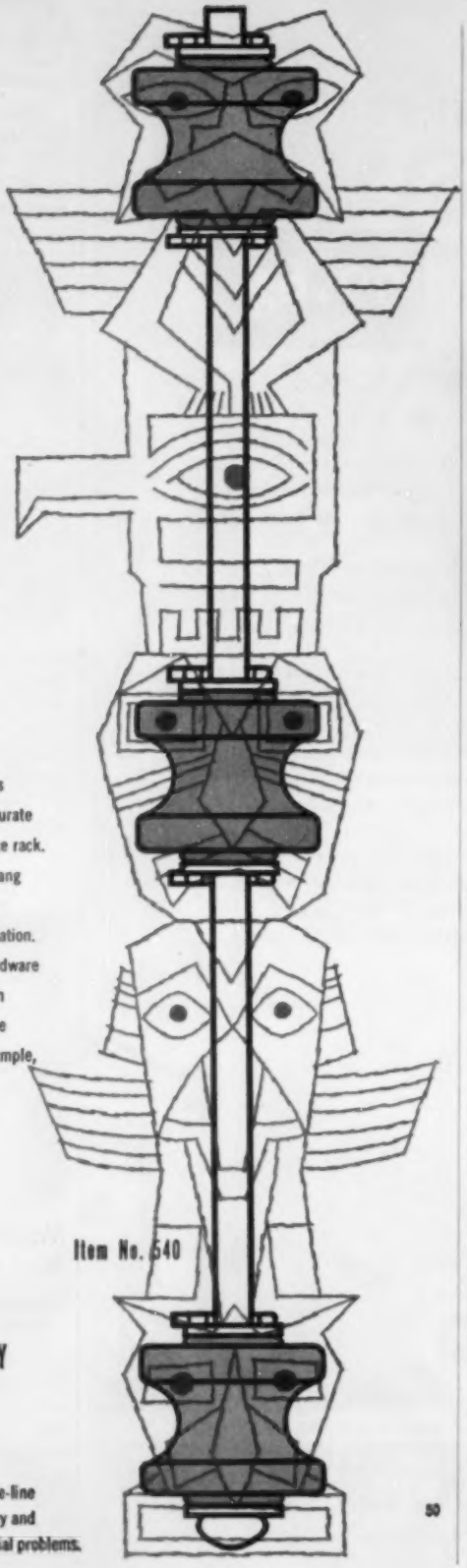
**JACKSON J. BAILEY**, Sacramento Division, Pacific Gas & Electric Co, Rio Vista, Calif.

Conductors may be removed easily from automatic line splices with a tool designed by the author. The device can accommodate splices for conductors ranging in size from No. 6 solid to 3/0 stranded.

The tool is a pair of 6-in. gas pliers modified by cutting ½ in. off one jaw and welding onto the end a ½ x ⅞

# high man saves a $30.00 pole

● Take off the red doodling on this picture and you will see a fairly accurate drawing of the E-M mid-span service rack. It can save you objectionable overhang on adjacent lots, an expensive pole relocation, or a new $30 pole installation. For with this neat little piece of hardware a crew can easily run a service from the middle of a secondary span. The savings are worth considering. A sample, our comprehensive new catalog, or a call by our representative is yours for the asking.



Item No. 540

EM

ELECTRICAL MANUFACTURING COMPANY
Battle Creek, Michigan

Designers and manufacturers of pole-line hardware that saves you time, money and maintenance. Prompt action on special problems.

80


x ⅛-in. piece of metal. This metal part is tapered to fit into the slot of a No. 6 solid plice. The tool is manipulated by inserting the metal wedger into the splice slot until the point enters the spring slot. The wedge then will hold the splice open. Conductor may be withdrawn easily with one hand while the splice is gripped with the pliers in the other.

## Computer Determines Low Bidders Quickly

High-speed electronic computers today determine quickly and accurately the low bidders on government contracts by a method based on the mathematical theory of linear programming. The combination of computer and method results in a speed and accuracy previously unobtainable in the solution of certain problems of supply and logistics.

The method, developed by the National Bureau of Standard, provides an exact basis for awarding contracts at least cost.

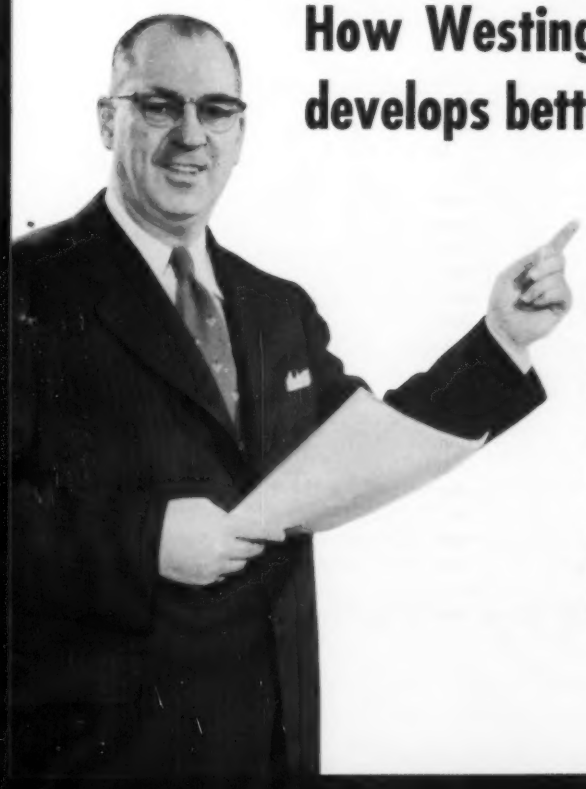
In applying the NBS method, the various conditions imposed by the government and the bidders are interpreted mathematically as problems in linear programming. On the basis of this initial analysis, one of several linear programming computation procedures previously coded for the computer is applied to the data of the specific problems. The computer usually obtains the answers in about two hours after the coded information has been placed in it.

In operation, the computer first chooses an award satisfying the various restrictions although not necessarily the least costly. The machine then searches for a cheaper allocation among the bids submitted. When there is none, the answers correspond-

(*Continued on page* 147)

**A. C. Monteith,** Vice President, Engineering, tells you . . .

# How Westinghouse engineering develops better products, better systems

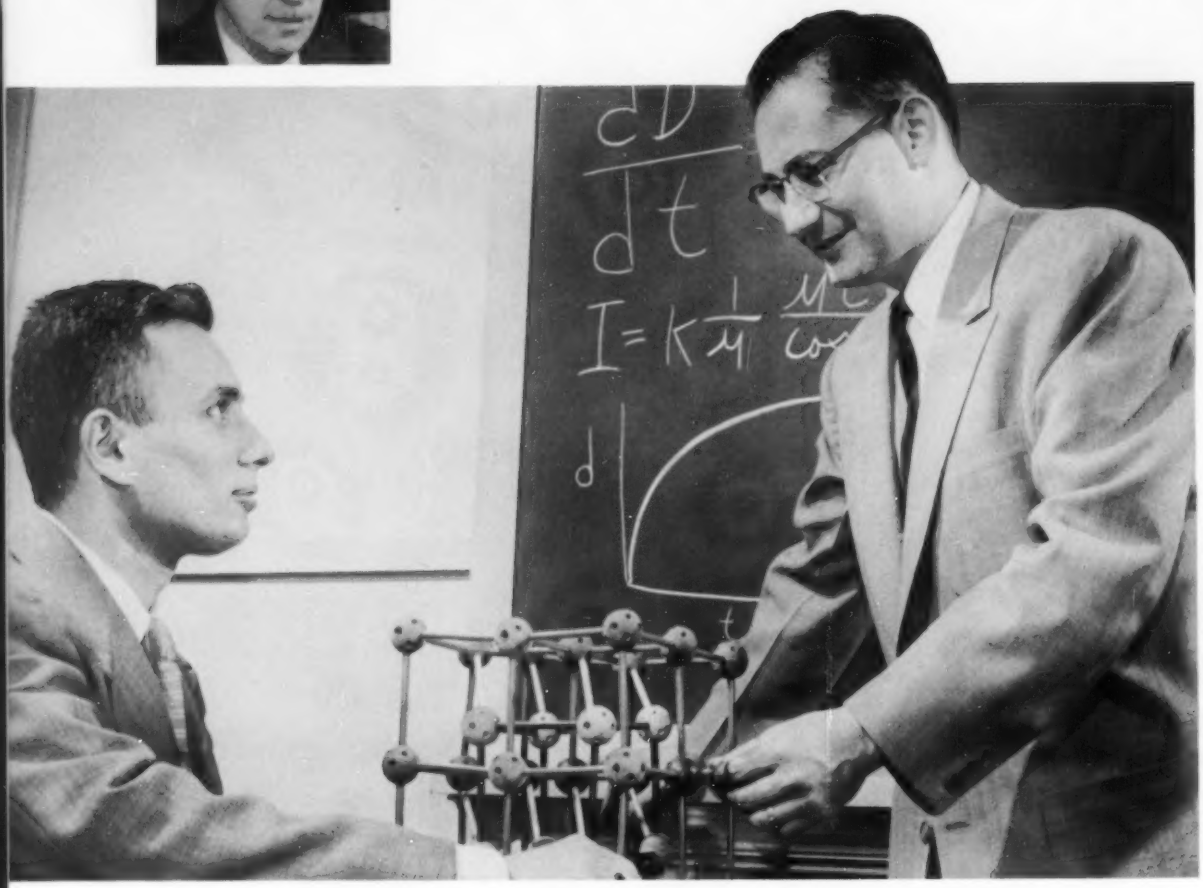


This team of Westinghouse engineering talent is well known to you. Guiding large staffs of engineers . . . in hundreds of departments and laboratories from end to end of the Westinghouse Electric Corporation . . . they maintain a balance of engineering from fundamental research to the engineering of products and systems.

These outstanding engineering leaders in the electrical industry help you provide more electrical energy to more people at less cost.

***The following seven pages will show you how well Westinghouse engineering facilities are matched to your needs for better products, better systems.*** ⟶

**Dr. J. A. Hutcheson,** *Vice President and Director of Research*



**Dr. A. Wexler** (right) Manager of Magnetics and Solid State Physics Research. This activity is making significant contributions to new and better apparatus. Here Dr. Wexler discusses grain orientation with Dr. Wiener, one of his staff.

# New ideas evolve from new knowledge

Fundamental research at Westinghouse reaches into the void where no knowledge now exists—finding the reasons *why* matter and energy behave as they do. Because these reasons are constantly opening doors to electrical progress, there is no greater facility for service to the electric utility industry.

When it was discovered, for example, that grain-oriented iron magnetizes with less energy, the superior Westinghouse Hipersil® core was developed . . . the most compact and efficient ever devised. From further inquiry into ferromagnetism, entirely new alloys may be created to provide equipment of revolutionary performance.

We now know that elongation of crystal lattices under magnetization sets up the vibration that becomes magnetic noise. The problem: Why do they elongate? Once we have answered that question, it may point a way toward elimination, not just cancellation, of "transformer hum."

Why does insulation insulate? Because we found the answer to that question, one development in solventless resins paved the way to Thermalastic® insulation . . . the insulation which has literally set new standards of apparatus performance.

Westinghouse Research is directing engineering progress along surer, shorter, more predictable paths. It offers you . . . now and in the future . . . equipment that does more and does it better.

**L. R. Hill,** *Manager of Materials and Equipment Engineering*

# New ideas take direction from applied research

In the broad span between fundamental research and the final product, the Materials Engineering Laboratories play the vital role of turning new ideas and materials into practical applications.

The versatile talent here is devoted to probing, exploring, identifying the practical. *Sureness* is designed into an idea before it leaves this department. Some projects are carried to design-sample stage; others, as far as pilot plant production. When thoroughly investigated, projects are turned over to operating divisions for final design and production.

Staffed by mathematicians, as well as engineers, the Materials Engineering Department calculates the probability of success of projects before they are ever begun. This analytical processing of new knowledge provides maximum impetus to discoveries of great promise, and brings you better products, sooner, more economically.

**Dr. S. J. Angello,** Manager, Semiconductor Engineering, exhibits a new semiconductor in which impurities have been reduced to one part in ten billion—an outstanding metallurgical accomplishment that may accelerate progress on lightning arresters and other apparatus.

**"Assistant brain"** in Materials Engineering is the digital computer used in calculating probability of success of experimental projects, and in fast, precise analysis of data.

**The Magamp*** regulator and excitation system was developed by Materials Engineering to provide reliable regulation for synchronous machines. This is the Magamp pilot plant.

**Trade-Mark*

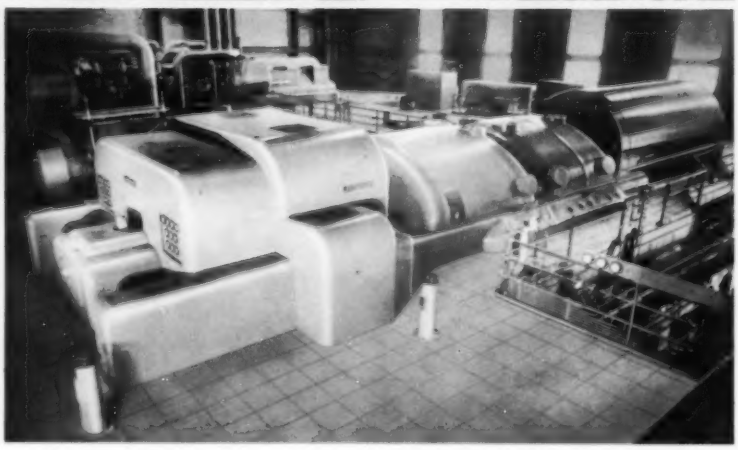
YOU CAN BE **SURE**... IF IT'S Westinghouse

# New ideas become new products through design and manufacturing engineering

Whether the project is a new product, or an improved product, it is in Design Engineering that final physical form is decided, and in Manufacturing Engineering that it is achieved. Here, new alloys become turbine blades; an insulation development becomes Thermalastic insulation for generators. Here, products are designed that not only meet Westinghouse standards of reliability, but that are practical to produce, competitively priced, and suited to your requirements.

Ever-increasing demand for higher equipment capacity and lower cost per kilowatt will be met by

**Design Engineering Departments,** such as this, throughout the many divisions of the company are centers of creative engineering, providing continuing progress in products for the industry.



**This modern tandem-compound, turbine-generator unit** is one of the largest 3600-rpm, single-shaft machines in service. Already new achievements have raised sights to 275,000 kw and beyond . . . at supercritical pressures and at considerably higher temperatures.

YOU CAN BE **SURE**... IF IT'S

the new Westinghouse supercritical-pressure turbine-generator. This record breaking unit will be designed for 5000 psi, 1200° F. Even at 5000 psi, 1150° F—at which it will operate initially—station heat rate will be much better than the most efficient station existing today.

Generator inner-cooling is another great engineering development of Westinghouse—making possible turbine-generators of 275,000 kw and larger, on a single shaft. To dissipate heat more effectively than ever before, hydrogen is literally blown inside both rotor and stator conductors.

Thermalastic insulation, in addition to providing never-before-achieved performance for turbine-generators, is now being applied with outstanding success to virtually all types of heavy rotating electrical apparatus offered to utilities.

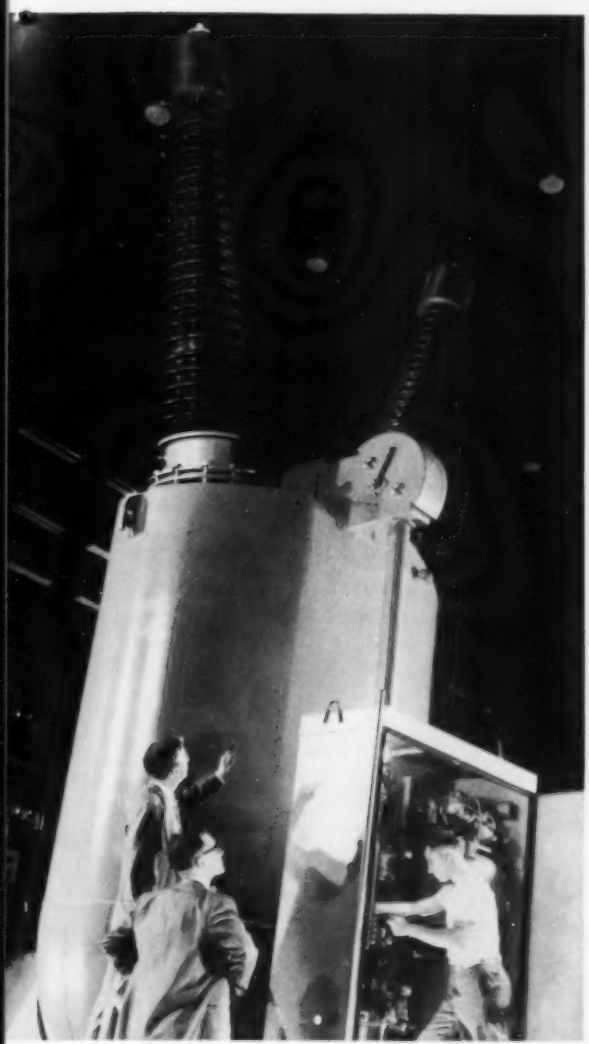
Advancements like these are sweeping aside the limits of turbine-generator capacity, and are establishing new criteria of efficiency and performance.

Let's consider, too, the power circuit breaker. Under guidance of Westinghouse creative engineering it has grown to the modern giant, "Big Ben," capable of interrupting 25,000,000 kva at 330 kv.

With the introduction of the multiflow grid, in 1941, Westinghouse provided the industry high breaker capacity in substantially smaller tank sizes, and cut arcing time from eight to three cycles. And, in 1950, Westinghouse brought out the Watchcase* breaker design, reducing oil requirements 50%.

Today, with an ever-growing investment in design leadership, Westinghouse effectively enables you to transmit larger and larger blocks of power in a manner that is both practical and profitable.

**Trade-Mark*



**H. N. Muller,** *Assistant to the Vice President, Engineering*
**Dr. J. A. Hutcheson,** *Vice President and Director of Research*
**D. E. Inman,** *Engineering Manager, General Products Divisions*
**D. C. Burnham,** *Vice President, Manufacturing*
**J. C. Fink,** *Engineering Manager, Apparatus Products Divisions*
**R. C. Bergvall,** *Engineering Manager, Defense Products Divisions*

**Watchcase circuit-breaker** tank design reduced oil content from 20,000 to 9600 gallons . . . another great power breaker advancement by Westinghouse engineering.

Westinghouse

# Over 200 laboratories are the workshops of Westinghouse engineers

**Advanced research and development** on steam and gas turbine equipment is conducted at the new Westinghouse Laboratory near Philadelphia. Here, 100 engineers and technicians work with the world's most modern facilities. Out of this laboratory will come the great developments of the future, helping the utility industry produce kilowatts at the lowest possible cost.

**The Westinghouse High Power Laboratory** at East Pittsburgh, Pa., is truly a design tool. Accompanying product development each step of the way, this huge facility is a proving ground for testing apparatus under actual fault conditions, before it is produced commercially . . . before it is offered to you.

**The new Research Center** just outside of Pittsburgh will house the finest facility of its kind in the industry.

YOU CAN BE **SURE**...IF IT'S Westinghouse

**J. E. Barkle,** *Manager, Electric Utility Engineering*
**M. B. Wyman,** *Manager, Engineering and Service*
**Dr. E. L. Harder,** *Director, Analytical Section*

# Engineering teams tailored to your needs

Here is Operation Interchange—Westinghouse Engineering and Service Department—where problems and needs of the industry are interpreted in terms of new products, applications and system ideas. This huge, closely knit organization of engineers and analytical facilities brings the best possible combination of engineering and service to bear on electric utility problems.

The focal point is the well-known Electric Utility Engineering Group at East Pittsburgh. The clearinghouse for all our utility engineering activities, it applies broad knowledge of the entire industry to your individual problems.

Westinghouse Consulting and Application Engineers in the field assist you with on-the-spot problems. They are equipped with a wealth of product application and system information, continually augmented by the Utility Engineering Department.

Westinghouse Service Engineers are located throughout the country to aid you in installation and operation of new apparatus and in servicing, inspecting, maintaining.

The finest analytical and computing facilities available back these engineers in their solutions of your problems. Outstanding examples are the digital and analog computers, and the a-c network calculator.

Your engineers will have valued assistance in Westinghouse specialized experience, and extensive laboratory and analytical facilities.

**World's largest network calculator** makes possible the solution of problems heretofore impossible.

## This engineering team serves you through *The Man With The Facts* . . . your Westinghouse sales engineer

Better equipment, better methods, better systems . . . and any Westinghouse service that will help you achieve them . . . that is what the Westinghouse sales engineer is selling. Through him, your problems or requests will open doors throughout the company, from research to installation service. Your Westinghouse sales engineer is *The Man With The Facts*—to help you convert needs into facilities, to help you market more power, more efficiently, more economically.

***Call THE MAN WITH THE FACTS . . .*** or write direct to Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

YOU CAN BE **SURE**...IF IT'S

**Westinghouse**

CP-1027

## Computer Determines

(*Continued from page* 134)

ing to the award first selected are printed on the output teletype. When a cheaper allocation has been found, the computer substitutes it for the original award and begins again to search for a still cheaper one. This process continues until no cheaper award can be found.

The number of searches varies with each problem, but approximates the sum of the number of bidders and the number of government depots for receiving the products involved. When the bidders' conditions are rather complicated, the problem occasionally requires several runs before the solution can be obtained.

In the illustration, the control console is at far end of computing room, and computer proper at left. At right are external units which store on magnetic tape such information as coded subroutines, instructions to machine, coded program for problem and its solution when completed.

## Safety Guard Used When Inflating Truck Tires

**HOWARD B. DEAN and THOMAS W. HILL,** Wheeling Electric Co, Wheeling, W. Va.

A safety guard protects Wheeling Electric Co's employees while inflating high-pressure truck tires. It is located near the air hose and requires no extra time or effort to use as the tire is simply rolled into the cage.

The guard is made by welding 1¼-in. standard pipe in the form of a 4½ x 3 x 1½-ft cage. The cost was about $16 including labor and material.

# DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

***Mail coupon for FREE Dosson "F" Connector***

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:

Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

Name _____ Title _____

Company _____

Address _____ Zone _____ State _____

City _____

50 YEARS OF TECHNICAL LEADERSHIP

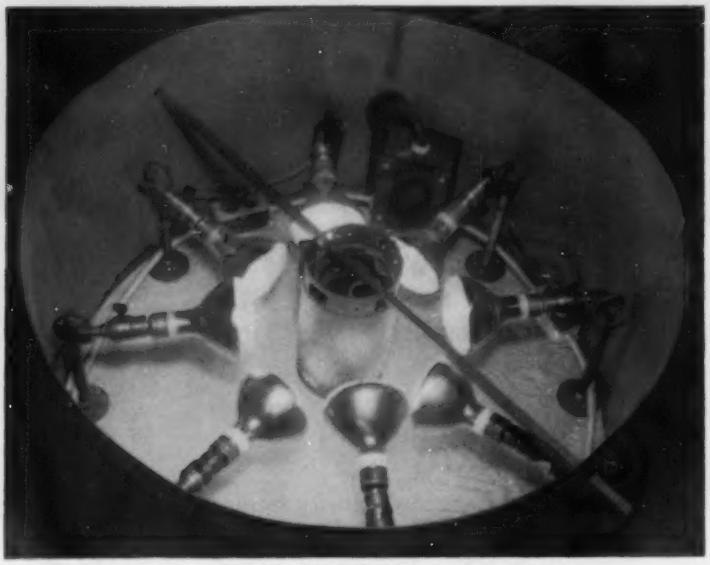
***DOSSERT MFG. CORP.***
**249 Huron St., Brooklyn 22, N. Y.**

## INDUSTRIAL APPLICATIONS

# Infrared Wins Industrial Acclaim . . .

## . . . because of savings and versatility

RALPH F. MEINBERG, Aircraft Motor Div, Robbins & Myers, Springfield, Ohio



MOTOR BODY SHELLS, costing $18.29 each, are now salvaged by infrared. Heat expands them and enables the fields to drop free. Formerly the magnesium shells had to be cut away

The savings accomplished during the first week of operation of an infrared lamp bank at Robbins & Myers, Inc, Springfield, Ohio, was $402.38. The lamp bank makes possible the reuse of magnesium body shells of aircraft motors by expanding them and permitting the fields to drop free from the body shell bore. The shells have a unit cost of $18.29. Previously, the motor body shells had to be split (and then scrapped) by a hand mill operation to save either one or the other of the two field assemblies, which were assembled into the body shell. Now in 3 to 9 min after the infrared bank (8-375-w lamps) is applied to the body assembly, the body shell expands the necessary minimum of approximately .007 in., and the fields drop free from the body shell bore.

Both field assemblies have an outside diameter of 5.312 in. Bore size of the magnesium body shell is 5.306 in. before expansion.

## . . . for high-speed drying and baking jobs

D. E. ALEXANDER, Chief Engineer, Victor Insulators Div, I-T-E Circuit Breaker Co, Victor, N. Y.

PORCELAIN INSULATORS are fed into an infrared "furnace" for baking under a battery of 48 250-w lamps. Infrared drying has speeded production 200%, improved quality, cut wastes

Infrared drying of insulator bodies has speeded production 200% for I-T-E's Victor Division. Because heat can be aimed at pinholes, petticoats, or grooves of specially shaped insulators, drying time has been shortened from hours, required by the convection method, to minutes. This reduces floor space devoted to drying, and cuts the mold inventory.

Insulator quality is improved, and preheating is obviated. This eliminates wasted heat and time. About 6 w of radiant energy per square inch is directed over the green clay in plaster molds by 48 lamp units, rated at 250 w each. Six rows of eight lamps form the infrared bank. A conveyor carries the insulators under the bank.

(*More Industrials on page* 152)

# ROEBLING TELLURIUM ALLOY LEAD SHEATH ASSURES FAR LONGER CABLE LIFE

Structure of Roebling Tellurium Alloy is shown in these Laboratory photomicrographs ... at left, before heat treatment ... at right, after treatment at 400° F. Note that little or no grain growth is apparent after heating. A fine grain size is desirable in regions of higher stress; as in duct splices.

BIGGER LOAD REQUIREMENTS! Higher temperatures! Increased movement of cable during load cycles! Today's best answer to each of these conditions is Roebling Paper Insulated Cable with Tellurium Alloy Lead Sheath*—the Roebling lead alloy that has completely superior resistance to fatigue.

In addition, Tellurium Alloy Lead Sheathed Cable has a lower long-time creep rate ... high bursting strength ... remarkable stability under heat application as in duct splicing and wiping. And on top of that, it eliminates need for frequent stop joints or reinforced lead sheath ... does not require generous expansion bends or large manholes.

Write us now for full information. John A. Roebling's Sons Corporation, Dept. 707, Trenton 2, New Jersey.

*Licensed under Patent 2586095 March 4, 1952 and App. No. 308710, Sept. 9, 1953.

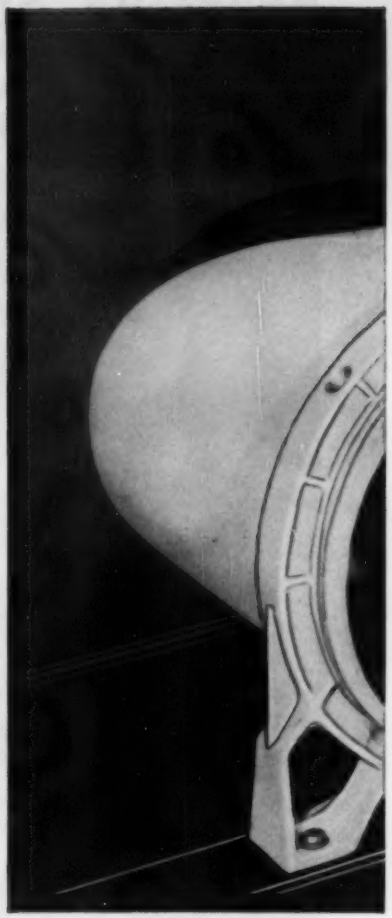
ROEBLING

SUBSIDIARY OF THE COLORADO FUEL AND IRON CORPORATION

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1928 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

# NEW

# REMARKABLE DEVELOPMENT by DELTA-STAR!



## Metal enclosed isolated phase bus structures

Here's Delta-Star's new engineering achievement in metal enclosed bus structures! New design permits easy, economical installation. New telescoping covers save time and money on inspection and maintenance.

Installation is simplified by *eliminating all bolted covers.* Instead, telescoping covers are clamped in position and locked with two screws. Longitudinal sections 6 to 8 ft. long can be pre-assembled and shipped in lengths as large as your facilities can handle. Pre-assembled conductor joints are pre-welded. Corners and tees are shipped *complete* with bus and insulators. *There are no longitudinal gaskets to cut and install.*

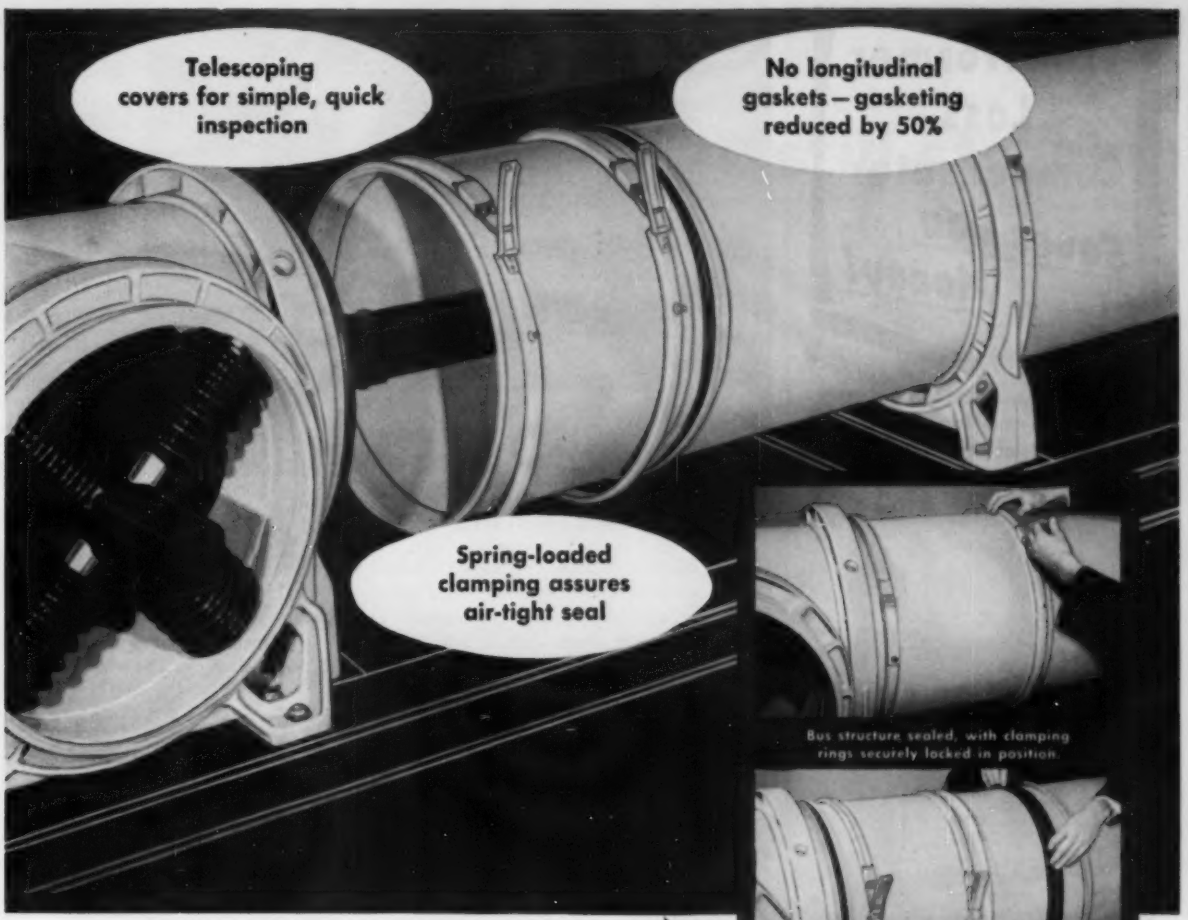
With telescoping covers, bus sections can easily be inspected, without tools. Simply remove two nuts which lock the clamping rings in position, then slide the telescoping cover out of the way. There's 2 ft. 6 in. open space for maintenance and cleaning when necessary. When cover is closed, toggle clamps with compression springs maintain constant pressure. Neoprene gaskets assure tight seal.

Cross section of telescopic cover, showing (A) cast aluminum ring, (B) removable clamping rings, (C) Neoprene gaskets and (D) sliding ring. Notice elimination of longitudinal gaskets.

Welding affords more rigid support for round enclosures—no need to depend on small cover bolts. No ring gaskets required.

Fastened circular extruded gaskets for air-tight seal. Fully trapped and self-seating.

Heavy extruded gasket forms insulation to limit flow of sheath current.


Telescoping covers for simple, quick inspection
No longitudinal gaskets—gasketing reduced by 50%
Spring-loaded clamping assures air-tight seal

# with telescoping covers

All sections are one piece and tubular in cross section. Thus they offer maximum strength against both internal and external pressures. Circular gaskets are fully trapped and self-seating. They protect against the elements, moisture and dust. Supporting rings of high strength cast aluminum alloy are welded to stationary tubular sections, affording rigid support for enclosures and eliminating the need for ring gaskets at these points.

For complete information about this new metal enclosed bus structure, be sure to talk to your Delta-Star representative. Or, write for Bulletin B.

Bus structure sealed, with clamping rings securely locked in position.
Clamping rings unfastened, ready for telescoping cover to be moved.
Cover slid back, open for bus inspection. Opening accomplished in 30 seconds!

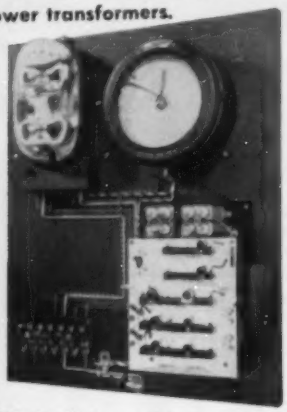
*For the best in high voltage electrical equipment—specify DELTA-STAR*

## DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

# Transformer Loss Compensator *Saves you Money!*

**BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.**



*This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.*

**THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.**

***Some of the Users . . .***

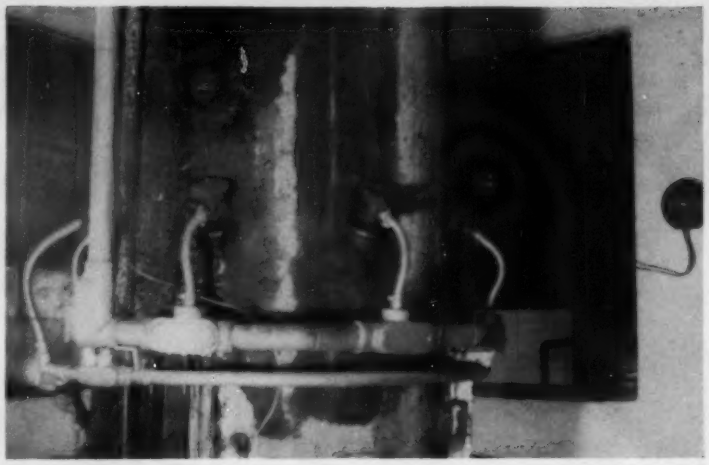
**Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.**

**Get your book now FREE**

**Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.**

**EASTERN SPECIALTY CO.**

**PHILADELPHIA 40, PA.**

## Immersion Heaters Improve Control

Heating catylist regenerating oil with immersion heaters at Southern Cotton Oil Co, Savannah, Ga., provides high temperatures, close control, safety and economical operation. The oil requires high temperature heat to be maintained within a 2F range. Installation consists of eight 5-kw immersion heaters in the 200-gal insulated tank. C. D. Anderson, Power Sales Engineer, Savannah Electric & Power Co, Savannah, Ga.

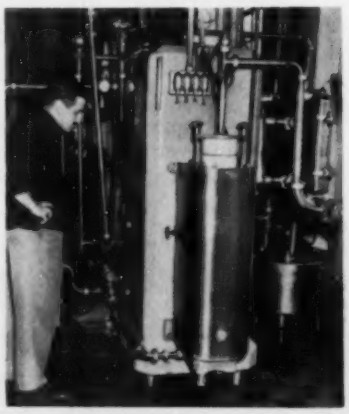
## Electric Pasteurizer Cuts Costs and Improves Milk

An electric pasteurizer provides many benefits for the Challenge Cream & Butter Association, Fresno, Calif. The unit makes possible a continuous operation that costs less, permits better temperature control of the product, and results in a higher quality of pasteurized milk. In addition, use of electric heat means a cooler dairy plant than was possible with steam.

Formerly up to 95% of all the steam from the plant boiler went into the pasteurizing process. But steam demands from other parts of the plant interfered with pasteurization as a continuous process. Heavy load on the boiler heated the plant unnecessarily in the summer. The new heater, rated 90 kva, 220 v, 3-phase, is one of two installations in California. Capacity of the unit is 10,000 lb per hour.

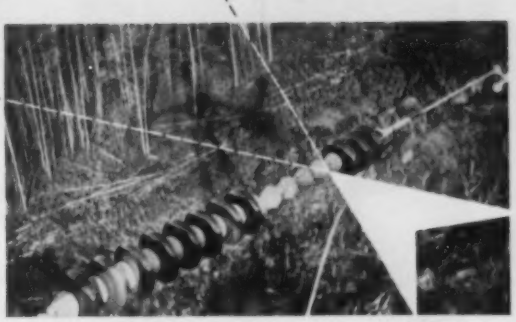
Use of electric heat allows pasteurization at temperatures as high as 190F without producing a cooked flavor. These higher temperatures are of direct benefit when the raw milk contains certain thermophilic or thermoduric bacteria. It would be impossible to exceed 169F with a steam pasteurizer because the milk sugar would become caramelized and cause a cooked flavor in the final product.

Because of the fine temperature control associated with electric heat, the unit can pasteurize skim milk fortified with vitamin additives, a product that was handled unsuccessfully in the old steam-heated unit. The association plans to add 10 kw of immersion heaters to heat the wax used to coat milk cartons. This job formerly was done by steam.



**MILK is better and men are cooler because electricity eliminated steam's handicaps**

# Smashed... and still strong



## thanks to liberal safety factor in O-B Insulators

Stripped of porcelain by a freak blasting accident, these O-B Suspension Insulators stayed on the tower—in service—for five days before they could be conveniently replaced. Afterward, the six battered units were sent to our laboratory for examination. Mechanically, all but one comfortably exceeded rated strength, and the exception was only a few hundred pounds short of that value. All others also sustained voltage sufficient to flash from the lower edge of the cap to the pin, indicating that the porcelain left within assembly areas between caps and pins was still sound.

This was the expected result from porcelain as an insulating material. It is not a heat-tempered material; does not have high residual internal stress. Therefore it is not subject to spontaneous, complete disintegration of the whole part if one piece is broken off.

Accidents of this sort tend to make prudent builders and operators expect the unusual, although they cannot predict what it will be, or when. Instead, they rely on O-B Suspension Insulators to perform far in excess of rated capacities if required to do so. Liberal safety factors are a responsibility which O-B accepts and meets in the manufacture of suspension insulators.

Ohio Brass

MANSFIELD OHIO, U.S.A.

4435-H

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

→ A Completely NEW LINE of Service Bodies with

# 25 FEATURES

## that give a new meaning to "UTILITY"

1. Models to fit 40 different Chevrolet, Ford, International, GMC, Dodge and Studebaker chassis . . . single or dual wheel.
2. For ½ - ¾ - 1 - and 1½-ton trucks.
3. 18 different compartment arrangements.
4. Exclusive 4-point coil spring body mounting.
5. Complete line of Service Accessories.
6. Bonderized, all-steel welded construction.
7. Double lap-type joints.
8. Extra-wide doors for easy access.
9. Larger, greater capacity compartments.
10. Embossed door panels for rigidity and appearance.
11. Fully recessed door handles.
12. All doors keyed alike.
13. Tumbler-type locks at no extra cost.
14. Full bolt-action locking bar.
15. Weatherproof compartments . . . lap-seal and gutter drain on all doors.
16. Raised bottoms of all vertical compartments provide extra protection for tools and supplies.
17. Heavy-duty reinforced 16-gage bulkheads.
18. Outside compartment headers 14-gage steel.
19. 4-way, 12-gage, safety tread non-skid floor.
20. From 25 to 35 sq. feet of floor loading area.
21. Through wheel housings for universal dual wheel application.
22. Reinforced tailgate.
23. Extra strength, bridge-type construction with interlocking lateral and longitudinal reinforcements.
24. Side boxes supported by one-piece cross members, reinforced at mounting holes.
25. Beaded fender panels hinged for easy access to wheels and spring shackles.

**For Better Service and Greater Utility . . . Specify**

# Morrison service bodies

→ **WRITE FOR DETAILS:** *Morrison Service Body Division* MORRISON STEEL PRODUCTS, INC. 695 Amherst Street Buffalo 7, New York

• Also manufacturers of MOR-SUN Furnaces and ROLY-DOOR Steel Garage Doors

## INDUSTRIAL BRIEFS

**The steeple** of the First Methodist Church in Morehead City, N. C., now houses 25 tons of air conditioning equipment to ventilate, cool, and dehumidify the building. No ductwork existed because the church was heated radiantly from pipes in its concrete floor. An overhead duct system was installed. The steeple was chosen to house the equipment because no other space was available for packaged conditioning units. Carrier Corp, Syracuse, N. Y.

**Speeded production** of chain-saw cutters is accomplished with two salt bath furnaces, totaling 48 kw, at Fate, Root, Heath Co, Plymouth, Ohio. Individually removable from the chain, the cutters are austempered as the final production step. The salt bath yields distortion-free hardening, thus eliminating need of straightening or sharpening. V. C. Schumacher, Industrial Sales Representative, Ohio Power Co, Bacyrus, Ohio.

**Electrically heated** truck engines are saving Consolidated Forwarding Co, St. Louis, Mo., driver time, engine maintenance, and many battery failures due to cold starting. Tractor engines are equipped with 750-w heaters in their cooling systems, and 62 of the 110 tractors can be connected at once to the outdoor outlets. Thermostats switch on the heaters when the temperature sinks below 40F. Marvin W. Myer, Industrial Sales Engineer, Union Electric Co of Missouri, St. Louis, Mo.

**Paint-can filling,** labeling, packing and printing is done automatically at Foy Paint Co, Norwood, Ohio, by a push-button production line. This process has cut unit costs, raised the production rate, and yielded greater product uniformity. Cans are carried through the process by a series of conveyors driven by individual electric motors powered by a 240-v, three-phase, 60-cps service. Paint feeds from an overhead tank to a pneumatically operated can-filling machine. The lid is clamped on, and the can is rolled over a gummed label and into a box. The box is automatically sealed and printed. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

# The economical selection for large motor installations in Class I Division II locations...

The motor with side-mounted cooler.

# ELLIOTT INERT-GAS OR INSTRUMENT-AIR-COOLED MOTORS

These motors are the modern answer to the problem of motor installations above 900 hp in hazardous areas. They represent a substantial saving over the cost of explosion-proof design, the saving in the larger sizes approaching 30%. Furthermore in comparable sizes they provide greater overload capacity, and their size range well exceeds explosion-proof types, going to 4000 hp.

Elliott "Fabri-Steel" construction makes it readily possible to supply these motors in both the types illustrated. The design is basically that of a totally-enclosed water-cooled motor, filled with inert gas or instrument air at .15 psig. Special seals on the shaft prevent gas leakage. Standard equipment includes indicating pressure gauge, low pressure alarm, and pressure regulator. Also, for inert gas, manifold and wall mounting brackets for gas bottles.

Your local Elliott field engineer has full details, or write Elliott Company, Ridgway Division, Ridgway, Pa.

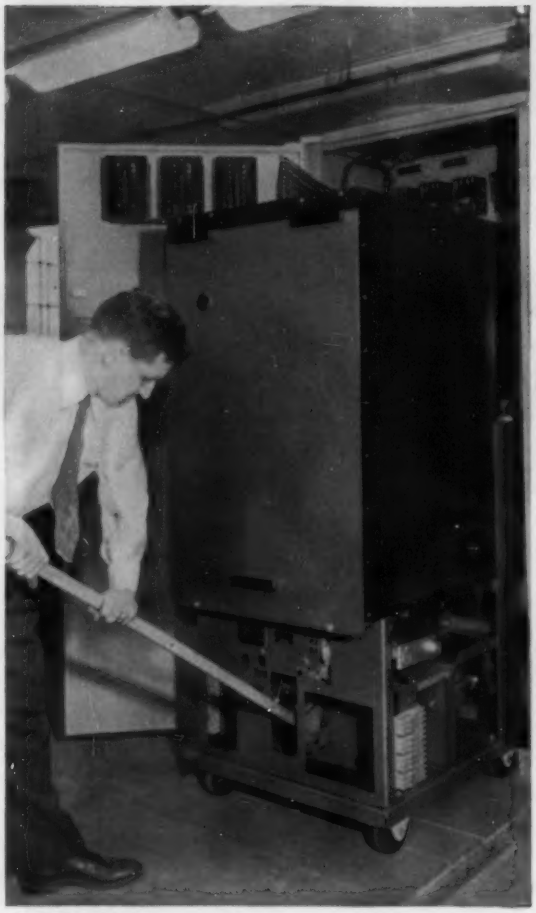
The motor with top-mounted cooler. The photo shows the Elliott squirrel-cage induction motor. Also available in synchronous design.

**ELLIOTT Company**

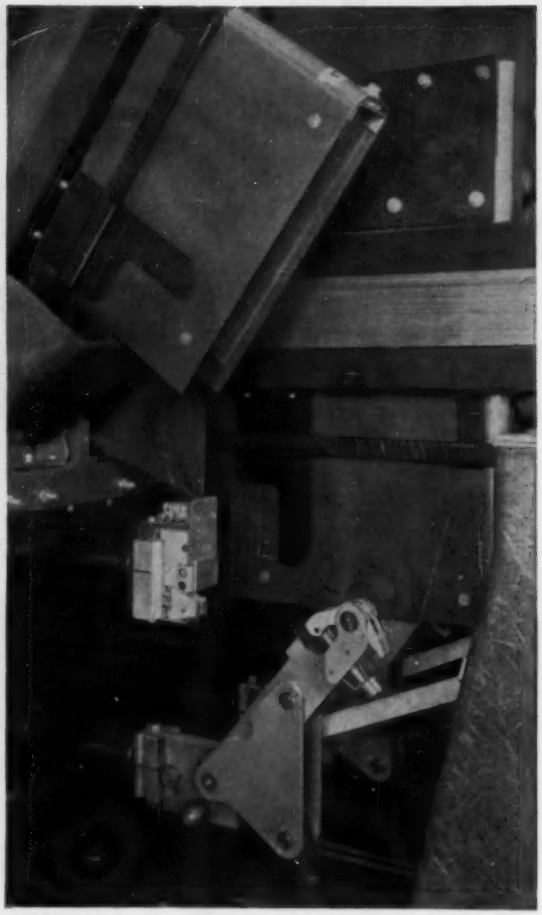
B4-8

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

# Come to the plant and going into I-T-E Metal-



**1. Horizontal drawout design.** Even heavy 15 kv circuit breakers, such as this one, roll out easily on permanently attached wheels. Breaker compartment is full-depth, one-piece welded frame, retains shape, permits lifting as a unit.

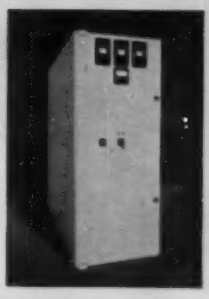


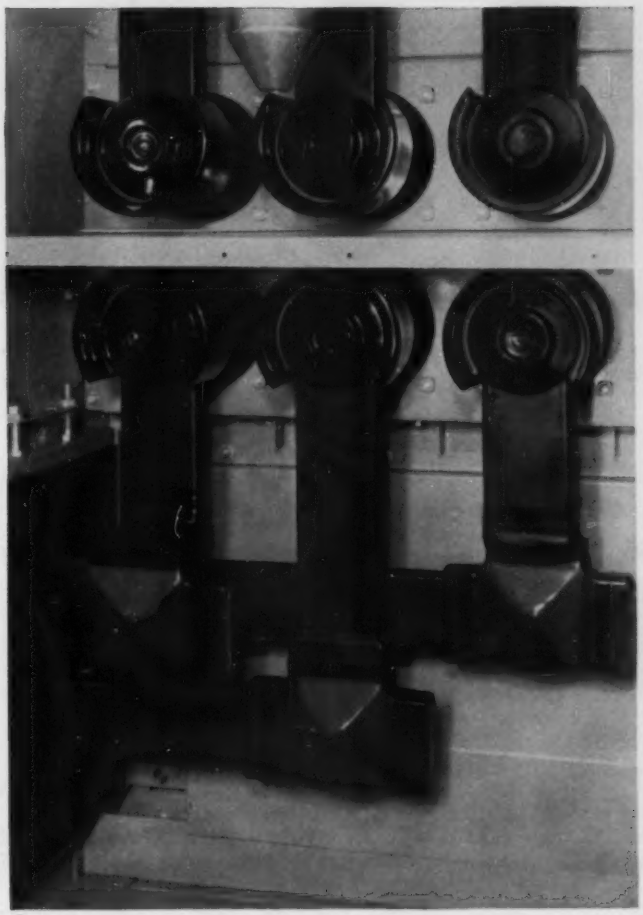
**2. Positive arc interruption.** On 15 kv breakers, double-coil, closed-iron magnetic blowout circuit draws arc rapidly into overhead quenching chute. Pivoting arc chutes, shown above, facilitate maintenance. Note sturdy contact assembly.

Discover in these pictures just a few of the extra-value, quality features in all I-T-E Metal-Clad Switchgear. They were taken right here in the I-T-E plant and show the equipment in process of manufacture.

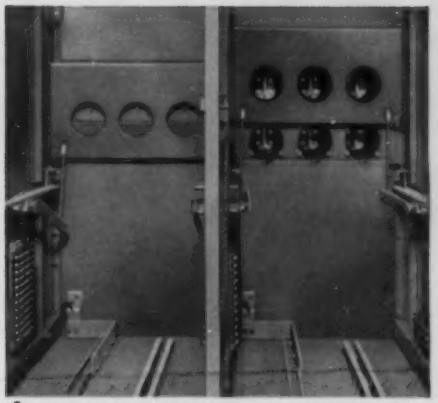
If you're planning new construction where you will need metal-clad switchgear, take a tip that can help you make the very most of your investment dollar: Visit the I-T-E plant here in Philadelphia. See the quality features actually being built into the equipment—quality that keeps I-T-E Switchgear performing more safely and dependably all the years it serves you. See the scenes shown on these pages, plus dozens more like them. See the extra value in I-T-E Switchgear that you won't find in any other

# see the extra value Clad Switchgear





**3. Bus rigidly braced, heavily insulated.** View into rear of 15 kv compartment shows porcelain disconnect bushings and bus supports which insulate and hold the bus in alignment during short circuit stresses. Steel paneling throughout forms isolated compartments.



**4. Superior isolation of compartments.** Gravity-type shutters, shown closed at left and blocked open at right, isolate primary terminals from breaker compartment.

**5. Fine, durable finish.** All panels and doors are sanded, bonderized and cleaned with spirits, then painted with three coats of enamel—baked on and rubbed down.

make. I-T-E Metal-Clad Switchgear is available in ratings through 13.8 kv, 500 mva.

For details, contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th and Hamilton Sts., Philadelphia 30, Pa.

I-T-E

**I-T-E CIRCUIT BREAKER COMPANY**
**Switchgear Division**

RURAL CO-OP MANAGERS like Sam J. Hord of Kentucky, above standing, along with power company presidents chairmanned workshop's round-tables. All aimed at finding methods to get farmers to use more power in production. This one dealt with water systems

# Will The Farm-Power-Use Program Work?

## The chances look promising as co-op and private company delegates get together to find promotional methods at Inter-Industry Council workshop

Outlook for getting American farmers to use more electric power looks better at the moment than it ever has before.

At least this was the general feeling of delegates at the close of Inter-Industry Farm Electric Utilization Council's National Power Use Workshop, Feb. 4 in St. Louis.

But with the optimism came another conclusion: The job, as the national council group has intended, is definitely going to have to be done locally. The workshop itself proved that. It served to point up the problems, not solve them. That, it appeared, was going to be up to the state organizations. As one power company's chief executive said, "The Council is no panacea. It's more or less an information clearing house. The 'do' part is still a local proposition."

An unexpectedly large crowd of some 400 representatives of power companies, rural cooperatives, manufacturers, government and educational groups from 38 states attended the two-day workshop session. They engaged in a program of promotional idea exchange calculated, as Council Chairman Fred Strong put it, "to increase profits and production for the farmer, and to build load for the power supplier."

The new loads that are to be built remain in the future, but noted one delegate, "it's bringing power companies and co-ops together in a way I've never seen before."

This spirit of cooperation was spelled out by Ancher Nelsen, administrator of the Rural Electrification Administration in the workshop's opening speech. Said he: "The go-it-alone days are over, and I think most of us realize it. The job of providing the nation with enough power is the concern of all groups of suppliers, public and private, commercial and cooperative."

One of the most talked-about speeches came from Edwin Vennard, president of Middlewest Service Co, who urged a selective farm power sales program designed to increase load factor as well as volume. The Chicago management and engineering consultant also questioned present rate making practices.

"Most electric rate schedules were designed about ten years ago when economic conditions were wholly different. These should be re-examined to make certain that the price charged for increased amounts of kwhr is above the cost of delivering the energy. There are indications among both electric cooperatives and power companies that uncontrollable expenses brought about by inflation have more than offset economies achieved through improved operating efficiency."

J. K. Smith, executive manager of the Kentucky Rural Electric Cooperative Corp, pointed to another problem in rural load building efforts: Adequate financing. The farmer must have a financial service that provides semi-annual and annual payments, he

# *For Troublefree Substation Performance*

## CHANCE Type H Rotating Stack Switches

Only 3 Moving Parts

Easy to Install

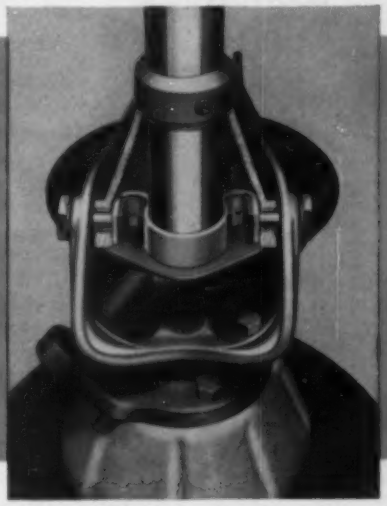
Continuous Hinge Contact

Switching operations on today's heavily loaded power systems demand rugged switches that are simple in design and have the ability to give years of unfailing performance—without maintenance—under any climatic conditions.

Chance Type H Rotating Stack Switches meet these demands because of features like *continuous hinge contact*. The contacts at the hinge end of *all* Type H switches are held under constant pressure in both the open and closed positions. U-shaped pressure springs carry no current and support no weight. The blade closes with a rotating motion that makes a clean, high-pressure contact . . . ice accumulations are broken with ease.

**Outdoor**
**Group-Operated**
**Airbreak**
**7.5 through 230 KV**
**400—600—1200**
**Amperes**

Cutaway view at right shows the hinge exposed. Contacts are completely enclosed at all times . . . protected from oxidation and corrosion. Pressure springs are made from beryllium copper.

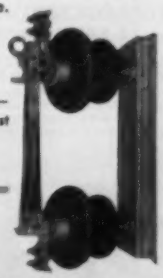


There are only three moving parts on the Type H—this means years of dependable, trouble-free performance. A universal control crank makes it easy to adjust the controls to within 5° of any position and permits the control mechanism to be easily adapted to any structure.

### USE CHANCE HOOK STICK SWITCHES, TOO!

Chance Hook Stick Switches are rated from 7.5 through 115 KV, 400—600—1200 Amperes. All meet NEMA and AIEE requirements and all pass the most severe tests for high currents, icing, insulation characteristics and long life.

*Write today for complete information on these Chance Switches.*



CS54-23

ABC INDUSTRIES

**A·B·CHANCE CO·**

CENTRALIA, MISSOURI · SAN FRANCISCO, CALIFORNIA

Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!

● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, specify Crapo Steel Strand for guys, messenger and overhead ground wires . . . and *save on maintenance!*

**REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS**

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

**Contact your jobber of Crapo Galvanized Products or write direct for further information!**

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

**COMPANY PRESIDENTS** such as Utah Power & Light's E. M. Naughton, center, headed workshop discussions like this one on advertising. Some 400 people attended the sessions

said, if he is to buy production equipment in any real amount. Present services available are not always satisfactory. He then told how Kentucky's rural cooperatives successfully set up their own credit organization to meet this long-term financing need.

An old hand at cooperative ventures, R. W. McClure, vice president of Kansas Power & Light Co, offered some tips on setting up state rural power organizations. His state's council, (in existence for many years under a predecesor group) said he already is getting set to survey farm equipment saturation.

This importance in knowing the farm market was stressed by two other speakers, Victor Hawkins, research director for Capper Publications, Topeka, Kan. and a farm promotion specialist from Gardner Advertising Co, St. Louis.

## What They Decided

With this, the crowd of delegates rolled up their sleeves and delved into the "work" part of the workshop. Mulling over rural loadbuilding problems in eight different round table groups, they came up with these observations:

● To put local power use programs into action, state groups should have adequate finances gained by token fees or by assessments of so much per farm meter. They should set up promotional calendars and coordinate promotional efforts through advertising media, personal contacts, schools, displays and exhibits. To check results they should use dealer reports and survey consumer interest. And equally important, said Roundtable Chairman O. B. Bryan, Cap Rock Electric Cooperative, each state group should act as an idea exchange with other state councils.

● On telling the power use story, Chairman E. M. Naughton, president of Utah Power & Light Co, stressed the need for localized advertising, coordinated so as to concentrate it on one type of appliance or piece of equipment at one time. Word-of-mouth testimonials by users are still the best, his group decided, but television and printed media must be relied upon for mass selling. One effective, inexpensive method: Place public service farm programs on local TV and radio stations. Most stations will air them at little or no charge.

● On Adequate Wiring: As elsewhere, its absence is strangling increased electric farm equipment sales, concluded this group headed by Harry Oswald of Arkansas State Electric Cooperative. There is a need to dramatize and put "sex appeal" into AW's appeal to the farmer; educational programs must be stepped up; re-wiring finance plans made more available; and inducements offered such as getting fire insurance companies to reduce rates on properties which voluntarily submit to regular wiring inspection.

● On training for greater sales, Chairman Allen S. King, president of Northern States Power Co, laid down these points: Responsibility rests upon many groups, power suppliers and educational institutions included; state and local education committees should be established using local farm forums, clinics, short courses, demon-

strations, etc.; all should be directed at farmers even in the most remote areas; power suppliers should develop farm use people among their employees to coordinate this training with other groups.

• On coordination with agricultural agencies, chairman Oscar Lowery, Public Service Co of Indiana said extension services, soil conservation service, Farmers Home Administration, etc, all can help to bring paths of scientific agriculture and the electric industry together.

• On the dealer: he holds the key role in sales, servicing and financing, reported chairman W. W. Lynch, president of Texas Power & Light Co. Council at local level must work closely with him providing promotional helps, sales training and equipment servicing instruction. Dealer's lack of interest must be counteracted by showing him farm equipment's sales potential.

• On market surveys, Chairman W. H. Wisdom's group discounted the feasibility of one single market survey form for national use. "Surveys must be developed locally and tailored to local needs," said Wisdom, manager of Iowa Rural Electric Cooperative Association. "We must take into account that methods of living and farming vary by region."

• On water systems, a great sales potential remains reported Chairman Sam Hord, Southern Kentucky Rural Electric Cooperative Corp. The headaches: Uncooperative plumbers and need for long-term financing. Suggested remedies: Enlist plumber cooperation, have power suppliers provide financing, promote "do-it-yourself" installations.

At the workshop's close came an announcement from National Electrical Manufacturers Association. Because the power use program is moving more and more toward local operation, Nema, a voting member of the council, said it felt it could better serve by retiring to an advisory capacity (EW, Feb. 14, p 6). Chairman Strong then declared the council proposes to broaden its representation and bring in dealers, distributors, contractors and other interested groups.

After it was over, Strong put a question to the delegates. "Is the workshop worthwhile," he asked. A hearty round of applause was his response. With that he announced a similar meeting for next year.

For Grounding Exposed Metal Parts of Portable Electrical Equipment

NEW

3-WIRE CONVENIENCE OUTLET

It's Rugged

A competitive, yet highly dependable, duplex flush-mounting receptacle for all practical applications — another example of Hubbell's ability to provide the best in design, materials, and performance even when price is an important consideration. Side-wired with grounding terminal and parallel slots, in brown bakelite and ivorine. Write for full details on its rugged dependability, or see your Hubbell distributor.

FEATURES

- Large-head binding screws for conventional wiring
- Break-off feature for two-circuit installations
- Hexagonal green screw for grounding wire
- Will accommodate two armored or rubber caps
- Slots for 2-wire regular and polarized caps
- U-shaped slot for ground blades
- Washer-type plaster ears
- Wire looping slot

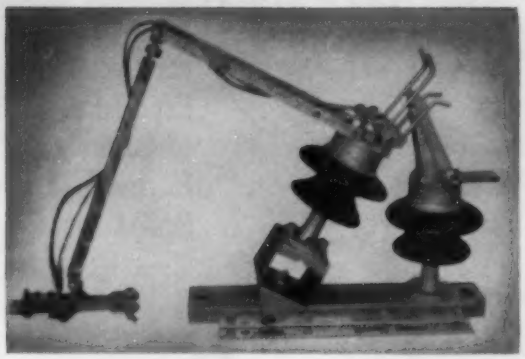
Highest Grade HEAVY DUTY WIRING DEVICES

HARVEY HUBBELL, INC.

Write Dept. E-2

BRIDGEPORT CONNECTICUT

# NEW EQUIPMENT



## Disconnect Switch

Tilting insulator switch has high-pressure beryllium-copper contact rods. The tilting insulator adapter is designed to stop firmly against the heavy channel switch base, preventing the contacts from absorbing the shock of closing. A dead-end clamp supplied as an integral part of the switch provides a snubbing action which is said to quadruple the holding power of the strain assembly.

The type AL-2 switch is designed for pole-top mounting and is built for operation on 7,500 to 46,000 v with current ratings from 200 to 1,200 amp.

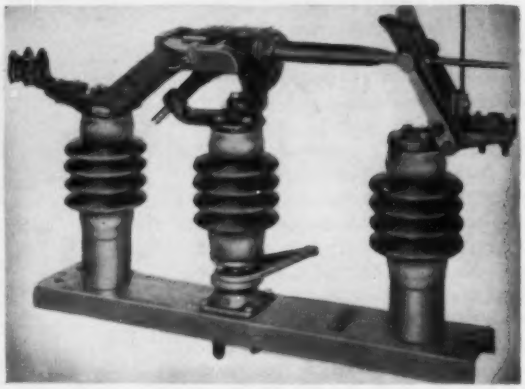
**Royal Electric Mfg. Co, 1122 East 87th St., Chicago 19, Ill.**

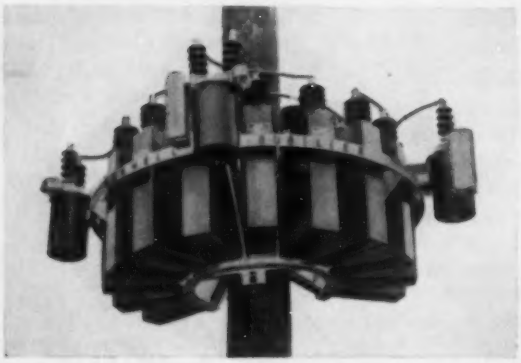
## Vertical Break Switch

Rotating blade on vertical break switch is said to be especially effective for use under icy conditions. The operating mechanism concentrates initial torque on rotating the blade and only enough subsequent force is needed to raise the weight of the blade. This eliminates much of the usual abrasion of contacts and stress on other parts.

The switch has high pressure contacts at both ends, has heavy silver surfaces at all contacts and locks in both open and closed positions. Ask for Bulletin 333.

**Electrical Engineers Equipment Co, Melrose Park, Ill.**





## Capacitor Rack

Capacitor life factor is said to be improved by circular pole rack design. The rack encircles over two-thirds of pole's circumference and can be mounted on standard poles without making any structural changes. It provides a capacitor arrangement that presents a minimum of wall area to the sun. Angular relationship of adjacent capacitor walls reduces re-radiation of heat.

Electrical connections are at angles more practicable for wye connections. Increased clearance between phases reduces possibility of phase to phase fault.

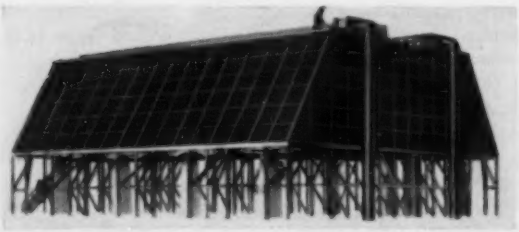
Wind loading factor is reduced since the rack presents less flat area in any one direction.

**Cornell-Dubilier Electric Corp, South Plainfield, N. J.**

## Cooling Tower

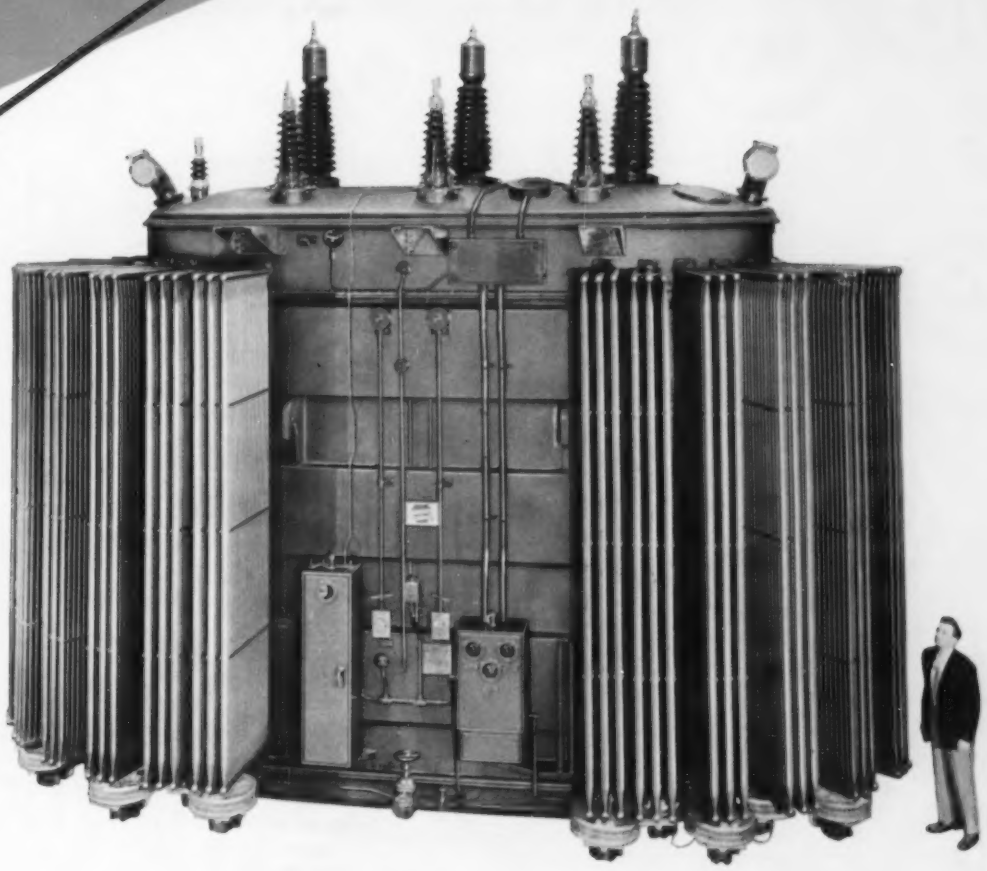
Improved operating efficiency by controlling recirculation and increased life span with reduced maintenance are claimed for new cooling tower design. It is said that the Wind-Trol eliminates the hampering effect of wind on its performance and, therefore, can be located without respect to wind direction. Uncontaminated air passes beneath the

(*Continued on page* 165)



# 100,000 Kva THREE PHASE

# Pennsylvania Auto Transformer



**Tying in a 69 Kv system to a 138 Kv system is the function of this 100,000 Kva forced-air cooled Pennsylvania Power Transformer. When operating without fans, the transformer carries a rating of 60,000 Kva. With ½ of the fans in operation, the transformer will deliver 80,000 Kva. In addition to a high voltage rating of 132,000 volts and a low voltage rating of 67,700 volts, the transformer has a tertiary voltage of 2400 volts at 13,100 Kva.**

**PENNSYLVANIA TRANSFORMER COMPANY**

*A McGraw Electric Company Division* • **CANONSBURG, PA.** • *Greater Pittsburgh District*

For inside story see next page . . .

# Inside a **100,000 Kva** *three phase*

# Pennsylvania Auto Transformer

Tap changers are mounted above core and coils where they are easily reached through large manholes in the tank cover.

Tap leads are connected to straight line tap changers through heavy pressboard tubes.

Two sets of taps per coil assure proper electrical and mechanical balance in the high voltage windings.

Coils are precompressed with a force equal to the highest short circuit stress and built into transformer at the compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

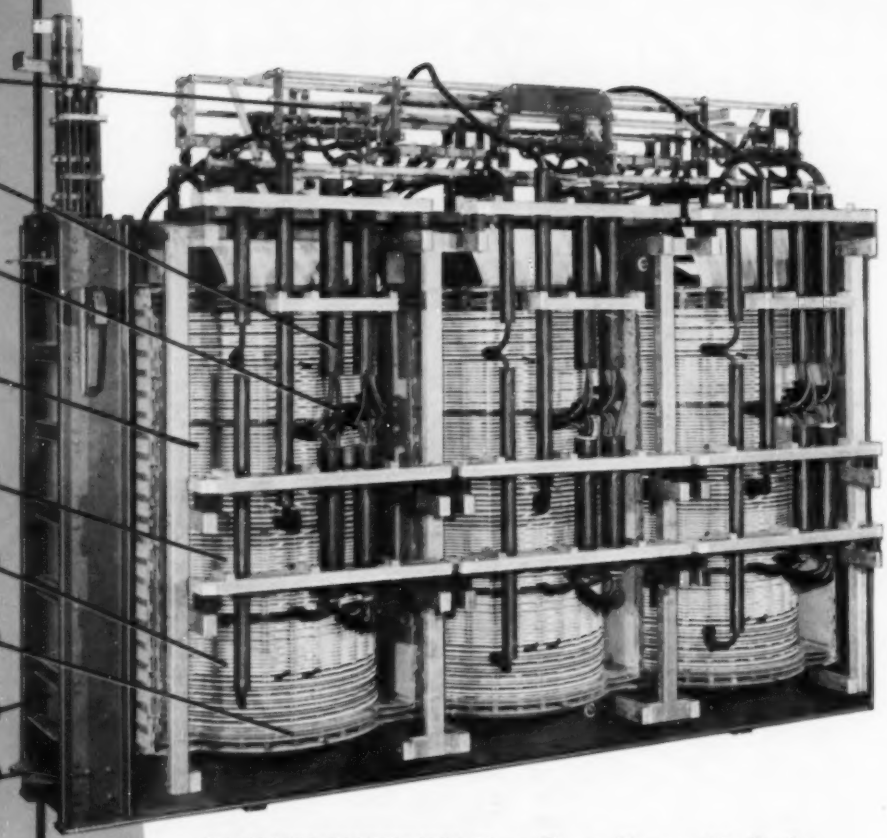
Circular coils electrically balanced both radially and axially against short circuit stresses.

Continuous pancake windings in high voltage and low voltage coils. Helical windings in tertiary coils.

Line ends of coils are heavily insulated to provide extra protection against surge voltage stresses.

Five-legged core reduces height of transformer.

Guide plates fix the position of the core and coil assembly in the tank.



60,000/80,000/100,000 Kva, Three Phase, 60 Cycles, 55°C. Temperature Rise. Forced-air cooled.
High voltage: 132,000 Grd.Y • Low voltage: 67,200 Grd.Y • Tertiary voltage: 2400Δ (13,100 Kva).

◀ external view of transformer see other side

**PENNSYLVANIA TRANSFORMER COMPANY**

*A McGraw Electric Company Division* • **CANONSBURG, PA.** • *Greater Pittsburgh District*

## New Equipment

(*Continued from page* 162)

structure and supplies forced draft fans on both sides of the tower. Excess air is discharged from the towers leeward side. Recirculation is prevented, since the exhaust vapors must move against this discharging wind stream.

The tower and its redwood basin are mounted on an open substructure. Forced draft fans are individually mounted on the ground. This design affords protection from costly vibration damage. Fans are placed so no harmful sunlight, rain, or hot vapors come in contact with blades or machinery.

**Santa Fe Tank and Tower Co. Inc, 5401 South Boyle Ave, Los Angeles 58, Calif.**

## Remote Control Switch

Bulletin 920 remote control switches are available with a control line fuse and adapter. The adapter may be purchased separately and added to existing remote control switches. The switches may be actuated by push buttons, timers, toggle switches, and similar devices to control lighting and power circuits. They are designed for simple installation on panel boards and switchboards, and for separate installation on sub-panels. Ask for Publication 559.

**Automatic Switch Co, 391 Lakeside Ave, Orange, N. J.**

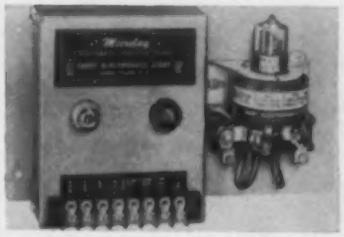
## Capacitors

Operation in ambient temperatures ranging from minus 40C to plus 46C is made possible by Diaclor, a

non-inflammable, stabilized, liquid dielectric. Diaclor completely fills the case and bushings. An internal reservoir maintains full insulation to case when the unit is end-mounted, even in the coldest weather. Capacitors are enclosed in all-welded, heavy gauge cases of either stainless steel or aluminum-metallized mild steel. Mild steel cases are treated for protection against corrosion and abrasion.

Sangamo Diaclor Power Capacitors are available in two ratings: 25 kvar, 2400v, and 25 kvar, 7200v. Bulletin 1120.

**Sangamo Electric Co, Springfield, Ill.**



## Electronic Relay

A small electronically controlled relay controls high power with current loads up to 60 amp or 3 hp, while operating from low-current, low-power circuits. Completely ac-operated, the device uses one commercial type 2D21 miniature thyratron tube to operate a mercury plunger relay. Relay is available with 35 or 60 amp contact ratings at 115 v ac. The relay's mercury-to-mercury operation is enclosed to permit safe operation in ex-

HERE'S SAFETY—SERVICE

you can always depend on. For Klein tools and equipment are designed better for your jobs—made of the finest materials—individually tested and inspected. Look for the familiar Klein trade-mark—serving the electrical industry "since 1857."

ASK YOUR SUPPLIER

*Foreign Distributor:*

International Standard Electric Corp., New York

*Write for your free copy of the Klein Pocket Tool Guide Today!*

Mathias KLEIN & Sons

PRESSURE & TEMPERATURE
SAFETY
PROTECTION

MERCOID
MERCURY SWITCH EQUIPPED
CONTROLS
SERIES "D"
FOR PRESSURE & TEMPERATURE

Over a million of these mercury switch equipped controls are in use throughout every industry in the world SAFE-GUARDING costly equipment against HAZARDOUS pressure and temperature conditions.
Pressure types are available in 17 pressure ranges from 0-30" vacuum to 300-2500 psi with the sensitivity your application requires. Temperature types range from minus 30° to plus 60° F., up to 370-530° F. with varying sensitivities dependent upon range selected.
All types are bourdon tube operated and are equipped with external adjustments, visible dial and the famous Mercoid sealed mercury contact.

FOR ALL TYPES OF SERVICE

FOR GENERAL PURPOSE Nema 1

WEATHER-PROOF OUTDOOR SERVICE Nema 1A, 2, 3, 4

EXPLOSION-PROOF HAZARDOUS LOCATIONS Class 1, Group D Class 2, Group E, F, G.

Our engineers are at your service—send in your control problem or WRITE FOR CATALOG 700B

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

## New Equipment

(*Continued from page* 165)

plosive atmospheres. Operating time is 35 milliseconds to make or break.

The relay is suited for such work as controlling motors, high-current heaters, oil refining apparatus, and electronic sorting, packaging, manufacturing or computing devices.

**Ebert Electronics Corp, 212-219 Jamaica Ave, Queens Village 28, N. Y.**

## Hydraulic Derrick

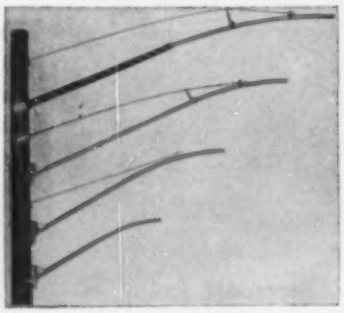
A fully automatic hydraulic derrick can handle loads up to 12,000 lb in setting 75-ft poles, and in loading such heavy objects as pipes, castings, transformers, and cable reels.

Thompson Hydraulic Derricks are available in three sizes: light, medium, and heavy duty, having 6,000 lb, 8,000-lb, and 12,000-lb capacities, respectively.

In one field test, the derrick was erected and a 3,000-lb load was picked up and put in a truck in 68 sec.

The derrick has no center leg to take up body space. There are no manual adjustments to be made to operate it, the company said.

**Thompson Trailer Corp, P.O. Box 356, Pikesville 8, Md.**

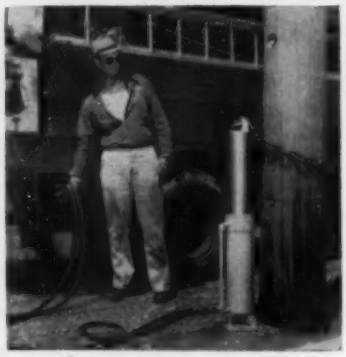


## Luminaire Supports

A line of upsweep luminaire supports is said to be particularly applicable to joint-use poles where space is at a premium. The manufacturer claims the supports offer ruggedness and durability along with economy, ease of installation, and graceful appearance.

Basic style of the line is an upsweep pipe support. The four styles, in varying lengths (two-foot increments), are: 4-6 ft without guy rod, 4-10 ft with guy rod, 8-16 ft with double guy rod, and 10-20 ft "A" frame with single guy rod. All are available in 1¼ in. steel or aluminum pipe. The "A" frame is also available in 2-in. steel or aluminum.

**Line Material Co, 700 West Michigan St, Milwaukee 1, Wisc.**



## Portable Pole Puller

Safe, fast, automatic pole pulling is claimed for a portable, hydraulic pole puller. Pole pulling is accomplished by one man and a crane operator. Essentially a double-acting hydraulic ram with detachable base, the Standard Pull Master has a lifting capacity of 28,000 lb at 1,000 psi and 42,000 lb at 1,500 psi. Pulling action is smooth and continuous, and always under close control for pole removal through wires.

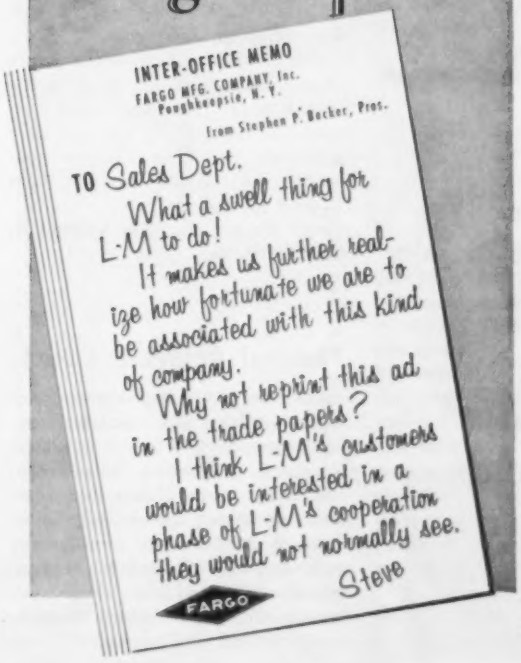
An idling motor in the truck supplies oil pressure which is controlled by a 4-way pressure relief valve. Large 5 in. diam shaft prevents misalignment and operates to a maximum 18 in. stroke. Ram withstands pressures to 2,500 psi and weighs approximately 82 lb. The detachable base, which serves as a foot for ram pressure, has a hinged connection permitting ram to tilt as pole is raised, then lowered. Base weighs approximately 24 lb.

**Standard Trailer Co, 415 San Leandro Blvd, San Leandro, Calif.**

## Latch-Held Relays

Mechanically held contactors and relays have been designed to maintain continuity of sequencing in the event of power interruptions. Also

# An open letter to the people of Poughkeepsie.


INTER-OFFICE MEMO
FARGO MFG. COMPANY, Inc.
Poughkeepsie, N. Y.
From Stephen P. Becker, Pres.
TO Sales Dept.
What a swell thing for L-M to do!
It makes us further realize how fortunate we are to be associated with this kind of company.
Why not reprint this ad in the trade papers?
I think L-M's customers would be interested in a phase of L-M's cooperation they would not normally see.
Steve
FARGO

Twenty-five years ago today, Fargo Manufacturing Company of your city, and Line Material Company of Milwaukee signed an agreement appointing L-M as sole sales agents for Fargo products.

Twenty-five years is not the world's endurance record for business agreements and this occasion might have passed unnoticed except for the fact that the arrangement has been so gratifying that several years ago, we began looking forward to this 25th anniversary as a milestone in our association with the people at Fargo.

As you probably know, Milwaukee's most glamorous industry is its baseball team, the Braves. However, we have many other industries less spectacular and hence not so well known even to the average well-informed Milwaukeean, but which, nevertheless add considerable stature to our city. We think of ourselves as being in this second category and it occurs to us that since Fargo Manufacturing Company probably occupies a similar position in Poughkeepsie, this 25th Anniversary of our agreement with them provides us with a long-sought opportunity to say publicly, what has so often been said privately within our organization.

As manufacturers and distributors of products for the electric power industry, we have literally hundreds of suppliers, jobbers and subcontractors. All are firms of the highest integrity, well managed, ethical and a credit to their respective industries. And so, we thought it would be a source of genuine satisfaction to the people of Poughkeepsie to know that we welcome this opportunity to say, in all sincerity, that not one of these contacts has been more pleasant or more rewarding than that which has existed for the past 25 years between us and your friends and neighbors at Fargo.

Their spirit of cooperation and their justifiable pride in their craftsmanship have been reflected in their product to such an extent that within the utility industry, Fargo products are as famous and as highly regarded as Milwaukee's Braves.

We at Line Material, are happy and proud of our association over the past 25 years with Fargo, its people and its products and welcome this opportunity to report this situation to you, the people of Poughkeepsie. In Fargo Manufacturing Company you have an institution and a group of fine people of which your entire community can be genuinely proud.

Sincerely,

W. D. Kyle Jr. *President*

LINE MATERIAL COMPANY
MILWAUKEE, WISCONSIN

**RICHARDSON-ALLEN**

**AUTOMATIC FLOAT CHARGERS**

*Why take chances?*

**Keep your substation batteries properly and fully charged with a**

**DEPENDABLE BATTERY CHARGER**

***RICHARDSON-ALLEN Automatic Chargers feature—***

- ★ Saturable reactor and magnetic amplifier control
- ★ Constant DC voltage ±1%
- ★ Automatic line correction
- ★ Long-life selenium rectification
- ★ Integral boost charge, if desired

***Write for technical bulletin. Prices on request.***

**RICHARDSON-ALLEN CORPORATION**

*a manufacturing affiliate of*

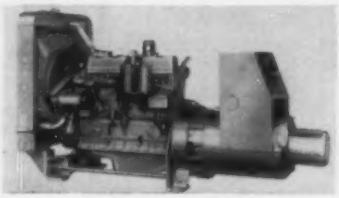
**Wesley Block & Co., Inc.**
**39-15 Main St. Flushing, N. Y.**

*In Canada:* Richardson-Allen of Canada, Ltd.
370 Victoria St., Toronto, Ont.


used where exceptionally quiet operation is required, the latched relays and contactors have only momentary coil hum during their energizing cycle. The contacts are locked mechanically until the latch coil is energized. For this reason when power is restored after a failure, sequenced operations will resume at the exact point in cycling where they were cut off, the company said.

Contactors are available in NEMA sizes 00, 0, 1, open and enclosed, and in 1, 2, 3, and 4 poles. Relays are available in 10-amp, 600-v max ratings, open and enclosed, and with 2, 3, 4, 6, and 8 poles.

**General Electric Co, Schenectady, N. Y.**



## Emergency Electric Plant

An emergency electric generating plant has been designed for hospitals, hotels, hatcheries, theatres, and utilities. Model 75HR is rated at 75,000 w, 93.75 kva at 60 cps; or 60,000 w at 50 cps. The gasoline-powered engine turns 1,800 rpm to generate 60 cps, or 1,500 rpm for 50 cps.

**D. W. Onan & Sons Inc, Minneapolis 14, Minn.**

## Smoke Indicator

A smoke indicator keeps an electronic eye on furnace smoke to help boiler room engineers operate within local ordinances. The devices can be installed on any type and size of furnace using any type and grade of fuel. Model 300-P90 provides adjustable automatic control for secondary (overfire) air injected to supply oxygen. Model 300-P85 gives an audible and/or visual signal only when corrective action is needed. Both have a continuously indicating smoke density meter calibrated in Ringelmann units.

**De-Tec-Tronic Corp, 2512 N. Halsted St, Chicago 14, Ill.**

## Emergency Light

An emergency light unit, topped by two 5,000-cp sealed-beam lamps, gives spot or flood lighting during power outages. Measuring 8 x 13 x 16 in., and weighing 50 lb, the unit has a built-in battery recharger that operates on standard electric power.

**Hobby & Brown Electronic Corp, 55 Front St, Rockville Centre, N. Y.**

## Small Motors

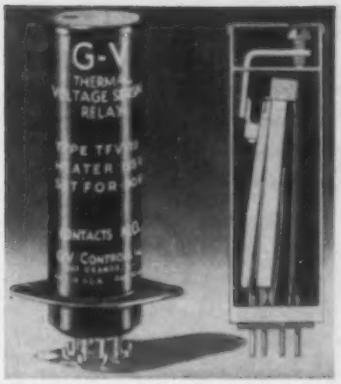
A line of skeleton and clutch-gear types of motors are now available in fractional horsepower sizes. Skeleton two-pole type motors are rated from 1/500 to 1/25 hp with operating speeds of 2,100 to 3,500 rpm in either direction. Voltage range is 6 to 220, at 50 or 60 cps. Starting torque is 10 in.-oz; running, 14 in.-oz. Shaft sizes are up to 13/64 in. dia.

The clutch-gear type disengages in 25 milliseconds, running at all speeds from 4 to 328 rpm. They operate on 6 to 220 v, 50 or 60 cps, and have 100-in.-oz torque at 25 rpm continuous duty. Shaft sizes are from ⅛ to ⅜ in. dia.

**Comar Electric Co, 3349 Addison St, Chicago 18, Ill.**

## Thermal Relays

Current- and voltage-sensing thermal relays have time constants ranging from 1 sec to 2.5 min. to protect equipment. Operating interchangeably on dc or ac of any frequency, their contacts are spst and may be ordered to close or open upon current or voltage rise. Differential between contact operating and release currents or voltages is about 1%. Contacts are rated for 3 amp at 115 v ac



non-inductive load, or at 28 v dc non-inductive. Relays operate from 0.015 to 5 amp and from 1 to 230 v.

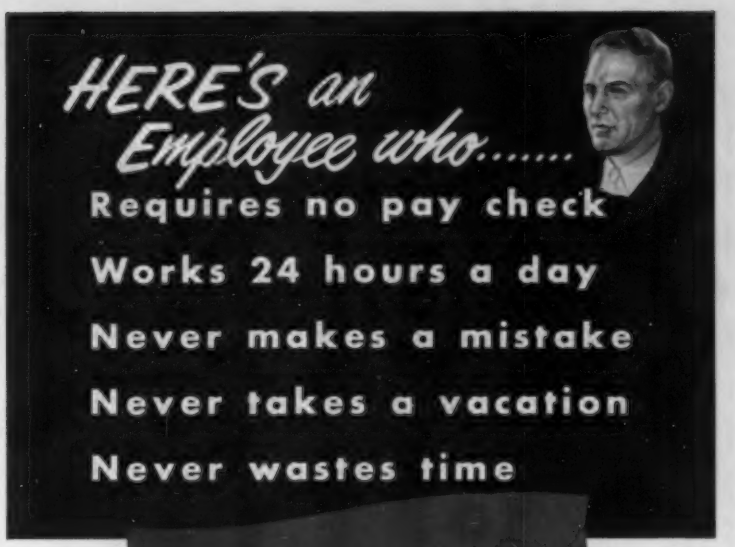
Applications include overload protection, over-and-under-voltage alarm or cut-off, voltage regulation, and battery charge control.

**G-V Controls Inc, 28 Hollywood Plaza, East Orange, N. J.**

## Fork Light

A light mounted on a forked aluminum support is easily pressed into the ground for temporary illumination. It consists of adjustable, non-rusting aluminum fittings, a two-tine fork, ½-in. extension, conduit nipple, sealed-beam flood lamp, rubber-covered wire, and plug. It is available with or without a weatherproof switch.

**Killark Electric Mfg Co, Vandeventer and Easton Ave, St. Louis 13, Mo.**



HERE'S an Employee who.....
Requires no pay check
Works 24 hours a day
Never makes a mistake
Never takes a vacation
Never wastes time

DIAMOND INDUSTRIAL (WIRED) TELEVISION

"UTILISCOPE" for special applications in heavy industry

"UTILIVUE" distributed by Graybar

Diamond Industrial Television has become an indispensable "employee" in many plants in a wide variety of industries. In their search for improved operation and lower costs, these companies have found the Diamond "Utiliscope" or "UtiliVue" the best answer to numerous problems. You, too, can probably use Diamond ITV to substantial advantage. For case histories and suggestions, return the coupon today.

7114

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

W

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO

Please send me without obligation a copy of new bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs, improve quality, increase sales and aid safety.

Name_____

Company_____

Address_____

# NEW Powerhouse on wheels!

## Trailer-mounted 5 or 10KW

# ONAN Electric Plant!

**More plug-in power for construction work . . . higher mobility for emergency standby applications!** On contracting jobs where high-line power is not available, the Onan "CW" gives you abundant power for all your electric tools, equipment and lights. Now you can use one unit (in place of several smaller portable plants) reducing servicing time and maintenance costs.

Onan "CW" Electric Plants are unusually compact, quiet-running and economical to operate: weigh only half as much as water-cooled plants of the same capacity. Powered by Onan two-cylinder, suction-air-cooled gasoline engines built with massive, long-wearing parts for continuous, heavy-duty service. Fully-protected by heavy-gauge steel housing; stay on the job in any weather.

**Wide range of accessories make the "CW" more versatile**

*You can equip your "CW" Electric Plants for any type of portable service with a wide range of accessories including skid, battery rack, 9-gallon fuel tank, weather-proof housing, two-wheel trailer, or 4-wheel, rubber-tired dolly. Put one of these portable, high-capacity units on your job now!*

*Onan builds electric plants for every need—400 to 100,000 watts*

*Write for folder A-362*

Onan ELECTRIC PLANTS

**D. W. ONAN & SONS INC.**

2839 University Ave. S. E. • Minneapolis 14, Minnesota


## CATALOGS • BULLETINS

● **BATTERIES:** Bulletin 210 (19 pages) gives detailed information on the application and operation of storage batteries for switchgear control and emergency light and power. Battery maintenance, installation racks and charging equipment information are included. Exide Industrial Div, The Electric Storage Battery Co, 42 S. Fifteenth St, Philadelphia 2, Pa.

● **LIGHT HOUSING:** Bulletin 1071, 1 page, describes Steberlite adjustable, weatherproof housing and mounting for use with medium base sealed beam lamps. Steber Mfg. Co, Broadview, Ill.

● **CIRCUIT CONTROL:** An 8-page bulletin entitled "Regohm Size 1 and 3 Type Designations" gives technical details of Regohm direct-action, finger-type electric circuit control units. Included are selection instructions and dimensioned outlines. Electric Regulator Corp, 506 Pearl St, Norwalk, Conn.

● **SLIDE RULE:** Catalog 164-A (32 pages) describes and illustrates metal slide rules and their applications from the simplest to most advanced type. Pickett & Eckel Inc, 1109 S. Fremont Ave, Alhambra, Calif.

● **AMPLIFIER:** A 4-page booklet describes operation and application of electro-mechanical amplifier for servo motors. Electomic Designs, P. O. Box 1156, Greenwich, Conn.

● **TELEVISION:** Catalog E.54 describes a control unit and remote unit of camera pan and tilt mechanism for use with industrial television. Radio Corp. of America, Engineering Products Division, Building 15-1, Camden 2, N. J.

● **TORQUEMETER:** Bulletin 4208 (12 pages) describes SR-4 Torquemeters and their applications. Dimensions and applications are included for manual null balancing instruments and automatic indicators and recorders. Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.

● **RUBBER GASKETS:** A 78-page book gives technical data on the properties and application of rubber and synthetic rubber compounds for various shaped gaskets. Included are ASTM specifications for rubber and a glossary of rubber terms. Minnesota Rubber & Gasket Co., 3630 Wooddale Ave, Minneapolis 16, Minn.

● **ADHESIVE:** A bulletin describes Placco 1000, a high strength adhesive agent for cable hangers and telephone wires. Included is a complete line of stainless steel and galvanized steel wire and cable hangers. Pioneer Latex and Chemical Co, Lincoln Blvd, Middlesex, N. J.

● **CABLE TRAYS:** Bulletin 754-A, 7 pages, gives construction details and dimensions of cable troughs, covers, connectors, and fittings for cable trough installations. Bulletin 1054 B, 4 pages, describes Twist-Rack supports for cable trough, conduit, shelving, cables, and pipes. P-W Industries Inc. Manufacturers, 4500 Melrose St, Philadelphia 24, Pa.

● **CRANES AND HOISTS:** Advantages of the Feedrail System of enclosed trolley busway electrification for cranes and hoists are described in 4-page Bulletin No. 44. Feedrail Corp, 125 Barclay St, New York 7, N. Y.

● **BOILERS:** Bulletin R-36, 20 pages, discusses the selection of proper refractory materials and the chief causes of refractory failure in boilers. Typical uses of refractory materials are described and illustrated. Babcock & Wilcox, 161 E. 42nd St, New York 17, N. Y.

THE STATES COMPANY

# Better Testing in 55

WITH

## STATES TESTING EQUIPMENT

Testing accuracy. Testing ease. Testing Economy —That's what you can expect and receive from dependable States Testing Equipment.

"FRD" with photo electric control. Also "FASD" which is similar design for automatic sequence testing.

PHASE SHIFTER TYPE R

Made in 50 to 2500 volt ampere capacities. Provides means for shifting phase continuously for every possible angular displacement. May be obtained as combination of phase shifter and induction regulator.

One of the many styles of Form "FRSS" Watthour Meter Test Tables with Strobo and photo-electric pick-up. Equipped with precision accuracy current transformer that permits the Strobo meter to operate always at 5 amperes.

THE STATES COMPANY
19 New Park Ave., Hartford, Conn.

Please send me further information on
☐ Test Tables ☐ Phase Shifters

Name..... Title.....

Firm Name.....

City..... Zone.... State.....

## TECHNICAL LITERATURE

**HEADGEAR SPECIFICATIONS**—"Specifications for Electrical Workers' Insulating Safety Headgear" is a 7-page booklet that applies to hats used by linemen and other electrical workers for protection against shock, burn, and falling and flying objects. Styles, dimensions, shell material, construction, and acceptance tests are among topics discussed. Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

**ASA CONFERENCE**—Proceedings of the Fifth National Conference on Standards have been compiled into a 100-page paperbound book. 40 papers are published in "Standards for a Strong America." They discuss international electrical standards and world trade, purchasing, architecture, safety, color TV, and other topics. Price: $3.00. American Standards Association, 70 East 45th Street, New York 17, N. Y.

**V-BELTS**—A hefty 100-page manual presents a scientific, simplified method for rating V-belts. Tables of engineering data help give complete information on products and range of stock size sheaves, with bore limitations. In addition to theories on V-drive engineering, such factors as small-diameter sheaves, centrifugal force, and average hr per day operation are considered. Worthington Corp, Mechanical Power Transmission Div, Oil City, Pa. Ask for Book No. V-1490-E2F.

**UNIONIZED ENGINEERS**—"Bibliography on Unionization of Professional Engineers" has been prepared to direct interested engineers and students to 100 pamphlets and articles in magazines from 1937 to 1954 which are in the Society's library. Bibliography No. 10 is 8 pages, mimeographed. Price: $2.00. Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

**SILICONES**—1955 Reference Guide to Silicones lists 23 new products plus 100-odd that were covered in the previous issue. It enables engineers to find a product by what it does, rather than by what it is. Tables, graphs and photos help contain copious information in a small space. Dow Corning Corp, Midland, Mich.

**HIGH TEMPERATURE METALS**—"Elevated Temperature Properties of Selected Super-Strength Alloys" is a 208-page report prepared by a joint ASTM-ASME committee. It summarizes graphically high-temperature strengths for 12 alloys, and includes 116 summary curves showing tensile strength. Offset yield strength, elongation and reduction of area, rupture stresses, and creep rates are shown. Price: $4.75. American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

**TURBINES**—Turbine Operating and Outage Data for 1953 is now available. A report of the Turbines and Condensers Subcommittee of the Prime Movers Committee, it presents data in table form for 404 turbines, 10,000-kw capacity and above, operating at 800 psi and higher, and contains a brief analysis of outages. Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

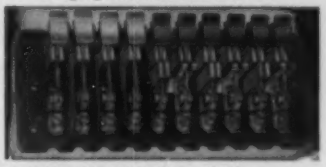
**FORMULAS**—"Formulas for Computing Capacitance and Inductance" contains specially developed equations for precision work at the National Bureau of Standards. Explicit formulas are given for computation of capacitance between conductors having a variety of geometrical configurations, the inductance of circuits of various shapes, the electrodynamic forces acting between coils when carrying current. The NBS Circular 644 contains 27 figures, 69 pages and sells for 40¢. Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.

THE STATES COMPANY

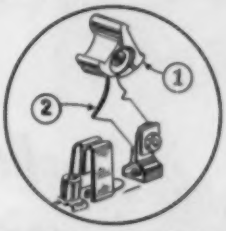
# Make Sure Your TEST BLOCKS have

## EXCLUSIVE STATES FEATURES

- New Safety Grip Handle Assures Safer, Easier Gripping.
- No Live Parts Extend Beyond Base.
- Maximum Pressure at Jaw Contracts.
- Large Selection of Pole Arrangements
- Nickel Corrosion Resisting Finish insures Good Contact, Attractive Appearance.
- Angle Bent Studs Permit Quick Changing of Front Connection.

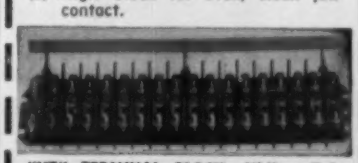


"SMK" TEST BLOCKS. Solid base type. Over 2,000 combinations of pole arrangements.




THE SAFETY GRIP HANDLE AND ANGLE EDGED BLADE

Add to the ease, safety and positive contacts of States Test Switches.
(1) New Safety Grip Handle available in 12 different colors.
(2) Angle Blade for even, clean jaw contact.



"NT" TERMINAL BLOCK. Sliding link feature. Any number poles desired.

THE STATES COMPANY
19 New Park Ave., Hartford, Conn.

I am interested. Please send further information on:
☐ Test Blocks ☐ N. T. Terminal Blocks

Name..... Title.....

Name of Firm.....

Address.....

City..... Zone.... State.....

# Volseal...

# the new high dielectric putty...

## makes sealing easier!

New Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 60, New York 16, N. Y.
In Canada, 199 Bay Street, Toronto 1, Ontario.

**Johns-Manville**
**SEALING COMPOUNDS**


# BOOKS

## Books Received Since January 5

*Transistors-Theory and Applications.* By Abraham Coblenz. Published by McGraw-Hill Book Co, New York 36, N. Y. 313 pages, illustrated. Price $6.00

*Transistor Audio Amplifiers.* By Richard F. Shea. Published by John Wiley & Sons, Inc., New York 16, N. Y. 219 pages, illustrated. Price $6.50.

*Interior Electric Wiring and Estimating, Part Two-Industrial.* By Kennard C. Graham. Published by American Technical Society, Chicago 37, Ill. 324 pages, illustrated.

*Sonics; Techniques for the Use of Sound and Ultrasound in Engineering and Science.* By Theodor F. Hueter & Richard H. Bolt. Published by John Wiley & Sons, Inc, New York 16, N. Y. 456 pages, illustrated. Price $10.00.

*Mechanical and Electrical Equipment for Buildings—Third Edition.* By Gay, Fawcett & McGuiness. Published by John Wiley & Sons, Inc., New York 16, N. Y. 564 pages, illustrated. Price $8.50.

*Electricity—Direct and Alternating Current.* By Charles S. Siskind. Published by McGraw-Hill Book Co, New York 36, N. Y. 538 pages, illustrated. Price $5.75.

*Circuits and Networks.* By Glenn Koehler. Published by The Macmillan Co, New York 11, N. Y. 349 pages, illustrated. Price $6.50.

*Alternating-Current and Transient Circuit Analysis.* By Harris A. Thompson. Published by McGraw-Hill Pub. Co, New York 36, N. Y. 317 pages, illustrated, Price $6.75.

*Big Dam Foolishness.* By Elmer Peterson. Published by Devin-Adair Co, New York 10, N. Y. 224 pages, illustrated. Price $3.50.

*Elements of Power System Analysis.* By William D. Stevenson, Jr. Published by McGraw-Hill Book Co, New York 36, N. Y. 370 pages, illustrated. Price $7.50.

*Storage Batteries—Fourth Edition.* By George Wood Vinal. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 446 pages, illustrated. Price $10.00.

*Magnetic Amplifiers.* By Dr. Herbert F. Storm. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 545 pages, illustrated. Price $13.50.

## Vibration Analysis

*Mechanical Vibration.* By G. W. Santen. Published by Philips Technical Library, Eindhoven, Holland. Distributed by Elsevier Press, Inc., 402 Lovett Boulevard, Houston, Texas. 296 pages, illustrated.

The author, associated with the Industrial and Measuring Apparatus Department of Philips Industries Ltd, Eindhoven, presents a uniquely practical book in a field where literature is skimpy and problems growing in importance as the tempo of design increases.

For the solution of problems in daily practice in research and engineering laboratories this work will be welcomed by designers of instruments and machines of all types where vibration of a detrimental nature must be detected, measured and eliminated.

It reviews the elementary theory of mechanical vibrations and some of the more important problems of vibration encountered in practice. Following a thorough development of vibration theory in early chapters the author turns to practical considerations in sections dealing with bending and torsional vibrations in shafts; damping, its application and measurement; detrimental effects of vibration as well as principles of equipment and instruments for the measurement of vibration.

## Lighting Gets History

*Lamps for A Brighter America.* By Paul W. Keating. Published by McGraw-Hill Book Co, New York 36, N. Y. 236 pages, illustrated. Price $4.00.

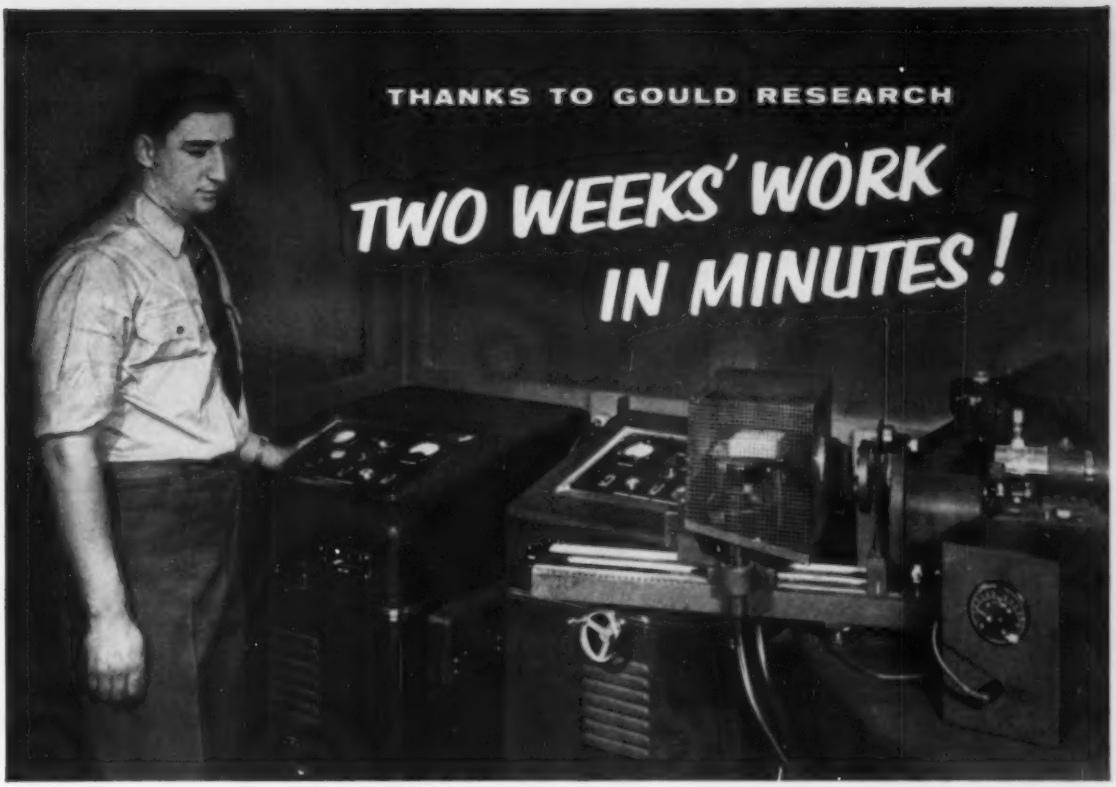
Starting with man's earliest efforts to provide light, this book moves to Edison's historic invention and on to the formation of General Electric Co. From there it traces the growth of GE's lamp business from all angles: engineering, research, legal, corporate, promotion and industrial relations. It is loaded with names, prominent and obscure,, of people who have played a part in the electric lamp's progress. Particularly well done are the sections on fluorescent lamp development and the establishing of Nela Park. Although the book could easily have been turned into a straight documentary record, Mr. Keating, by filling it with romance and human interest, makes it read like a fascinating novel.

## Railway Electrification

*Electric Traction, 3rd ed.* By A. T. Dover Distributed by Pitman Publishing Co, 2 W. 45th St, New York 17, N. Y. 434 pages, illustrated. Price $12.50

Fundamental principles of electric traction are included for railways, tramways and trolleybus routes. Commercial battery road vehicles are also considered. Among the subjects covered are: Mechanics of train movement, motors and controls, regenerative braking, auxiliary equipment, rolling stock, track and overhead construction, speed-time curves, and distribution systems.

In this revision additional subjects include: Developments in single-phase traction at 50 cycles, the application of mercury arc rectifiers to railway vehicles, and use of self-propelled thermo-electric locomotives. Problems and answers are included. This third edition can serve very readily as a textbook as well as a reference book for electrical engineers and advanced students.

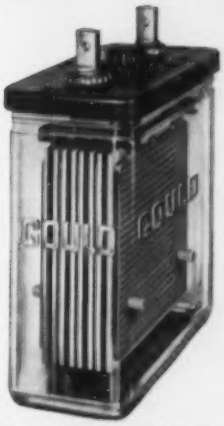



## ONE REASON WHY YOU GET

# BETTER BATTERIES FROM GOULD

The Spectrograph pictured above makes as many alloy analyses in minutes as a chemical laboratory can produce in weeks . . . reveals traces of impurities in quantities as small as .0001%! It is one of the most important and useful instruments in the great Gould Battery Research Laboratory at Depew, N. Y.

Thanks to this and a host of other research instruments, Gould plates are virtually free from impurities . . . give extra months of service . . . provide top performance and longer trouble-free life. Thanks to research, you get better batteries from GOULD!




America's Finest!
GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

*Always Use Gould-National Automobile and Truck Batteries*

**"BETTER BATTERIES THROUGH RESEARCH"**

**GOULD**
**Batteries**

**GOULD-NATIONAL BATTERIES, INC.**
**TRENTON 7, N. J.**

©1955 Gould-National Batteries, Inc.

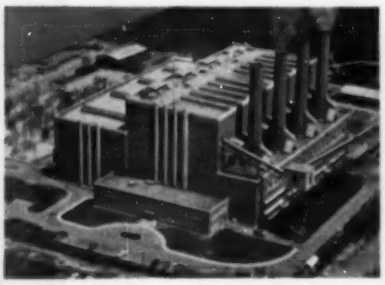
# WORK DONE – WORK DOING
## . . . *for these Companies*

Baton Rouge Electric Company
(*Now part of Gulf States Utilities Company*)
Boston Edison Company
Boston Elevated Railway Company
(*Now Metropolitan Transit Authority*)
Central Illinois Electric and Gas Company
Cliffs Power and Light Company, The
Columbus Electric and Power Company
(*Now part of Georgia Power Company*)
Compania Electrica de Santo Domingo C. por A.
Connecticut Power Company, The
Consolidated Mining and Smelting Company of Canada, Limited
El Paso Electric Company
Great Western Power Co. of California
(*Now part of Pacific Gas and Electric Company*)
Gulf States Utilities Company
Hartford Electric Light Company, The
Houghton County Electric Light Company
(*Now part of Upper Peninsula Power Company*)
Hydro-Electric Power Commission of Ontario, The
Indiana Electric Corporation
(*Now Public Service Company of Indiana, Inc.*)
Jamaica Public Service Company, Ltd.
Key West Electric Company, The
(*Now Key West Electric System*)
Louisiana Steam Generating Corporation
(*Now part of Gulf States Utilities Company*)
Lowell Electric Light Corporation, The
Luzerne County Gas & Electric Corporation
(*Now part of The United Gas Improvement Company*)
Lynn Gas & Electric Company
Maine Public Service Company
Manchester Traction, Light & Power Company
(*Now part of Public Service Company of New Hampshire*)
Marion-Reserve Power Company, The
(*Now part of Ohio Edison Company*)
Mississippi River Power Company
(*Now part of Union Electric Company of Missouri*)
Montaup Electric Company
New Bedford Gas and Edison Light Company
Newport Electric Corporation
Niagara Mohawk Power Corporation and predecessor companies
Northwestern Electric Company
(*Now part of Pacific Power & Light Company*)
Pacific Gas and Electric Company
Pacific Light & Power Corporation
(*Now part of Southern California Edison Company*)
Philadelphia Electric Company, The
Potomac Electric Power Company
Public Utility District No. 1 of Chelan County, Washington
Puget Sound Power & Light Company
Queens Borough Gas & Electric Company
(*Now part of Long Island Lighting Company*)
Roanoke Rapids Power Company
(*Now part of Virginia Electric and Power Company*)
Sao Paulo Light and Power Company Limited
Savannah Electric & Power Company
Sierra Pacific Power Company
Southern California Edison Company
Southern Utah Power Company
Susquehanna Power Company, The
(*Now part of Philadelphia Electric Company*)
Tampa Electric Company
Union Electric Company of Illinois
Union Electric Company of Missouri
United Power & Light Corporation, The
(*Now part of The Kansas Power & Light Company*)
Upper Peninsula Generating Company
Virginia Electric and Power Company
Western Massachusetts Electric Company
Western United Gas & Electric Company
(*Now part of Commonwealth Edison Company*)
Williamsburgh Power Plant Corporation
(*Now part of New York City Transit Authority*)

•

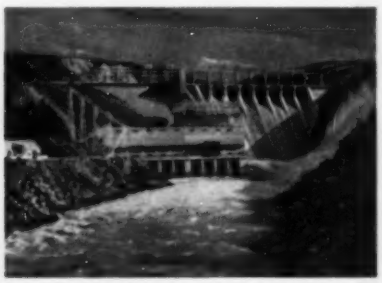
More than 100 power plants also have been designed and built for leading industrial companies.

***Write or call us for information as to how our experience* may be of assistance to you.***



RICHARD L. HEARN STATION

OSAGE HYDRO DEVELOPMENT



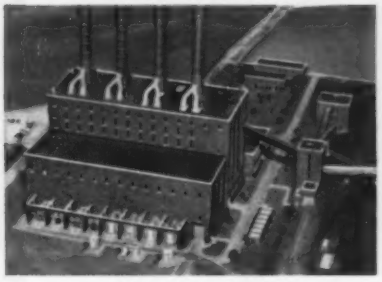
WANETA HYDRO DEVELOPMENT

* ***EXPERIENCE:*** **Starting 65 years ago, the Corporation's work in the steam power field alone aggregates in excess of 11,300,000 kw in capacity, equivalent to about 16% of the utility steam generating capacity in the United States. Hydroelectric projects, with a capacity equal to about 10% of the present privately-owned hydroelectric capacity of the United States, also have been built by the Corporation. *These installations, both steam and hydro, have ranged from small industrial or utility installations to superpower stations.***

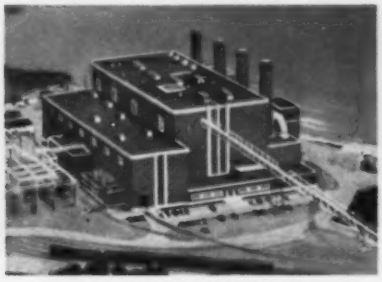
ETIWANDA STEAM STATION

CHESTERFIELD POWER STATION

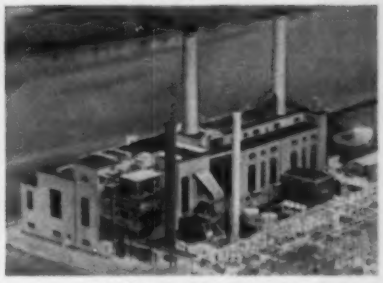
SOMERSET STATION



OSWEGO STEAM STATION



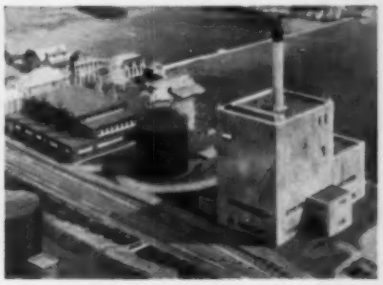
POTOMAC RIVER STATION



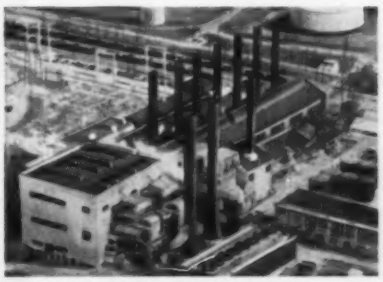
NECHES POWER STATION

MIDDLETOWN STATION

ROCK ISLAND HYDRO PLANT

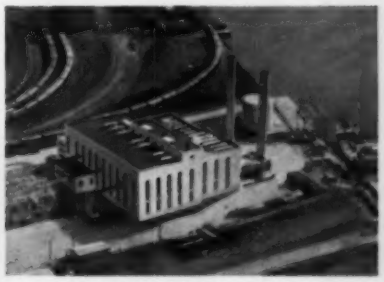


CARIBOU STEAM STATION

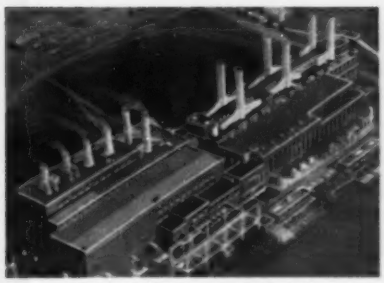


LOUISIANA STEAM STATION

SABROOKE POWER STATION

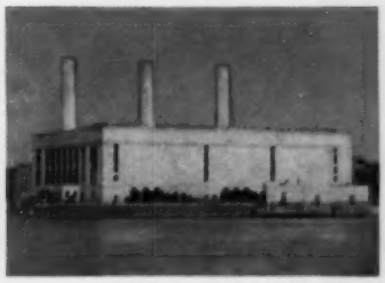


HOOKERS POINT STATION



HUNTLEY STEAM STATION

MOSS LANDING STATION



BUZZARDS POINT STATION

Representative illustrations taken from recent Engineering Corporation advertisements.

# STONE & WEBSTER ENGINEERING CORPORATION

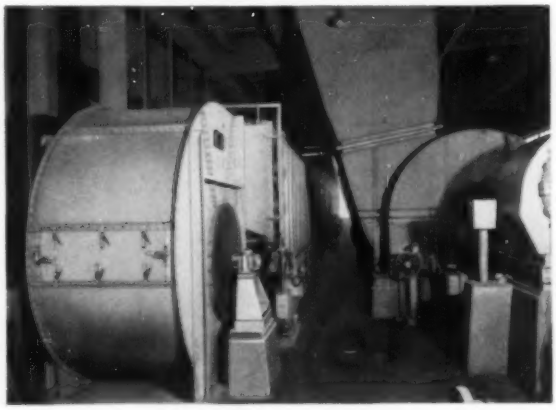
**A SUBSIDIARY *of* STONE & WEBSTER, INC.**

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

# INSTANT REPLY TO THE CALL FOR KILOWATTS

## SPECIFY DRAFT BY "BUFFALO"

Ever since draft became "mechanized", vital utility stations and plant boiler rooms have been relying on "Buffalo" Draft Fans for that immediate, comforting response to load demands. We've always concentrated on building exceptional long life and reliability into these fans, too, because we know this makes for better and cheaper power production. We call it the "Q" Factor*. It will pay you to write for Bulletin 3750 and see the efficiency, durability and serviceability built into these fans.



*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

**BUFFALO FORGE COMPANY**

212 MORTIMER BUFFALO, N. Y.

*PUBLISHERS OF "FAN ENGINEERING" HANDBOOK*

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

*Sales Representatives in all Principal Cities*

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

TORCH LIGHTED by Cherokee "Eternal Flame" is presented to L. B. Cherry (right), GE, and L. H. Hodges, North Carolina governor at ground breaking ceremonies for new GE outdoor lighting center. Torch activated photo-electric cell and light to signal start of operations

# GE Starts 'Lighting Center'

The future of the Hendersonville, N. C., area and the future of the electrical industry are interwoven. This statement was made Feb. 4 by Philip D. Reed, chairman of the board of directors of General Electric Co, before the Hendersonville Chamber of Commerce. Earlier in the day he participated in the ground-breaking ceremonies of GE's new multi-million-dollar "Outdoor Lighting Center."

Referring to the new plant, Reed said, "The product of this factory will mean more time for many outdoor activities all over the country. It will mean the saving of thousands of lives and millions of dollars from after-dark traffic accidents. It will mean greatly reduced crime. These are some of the contributions that Hendersonville, as the 'Outdoor Lighting Center of the World,' will make at a national level."

The plant will be built on a 62-acre site in East Flat Rock Township, four miles south of Hendersonville. Employment will be about 600 persons (approx $2 million annual payroll) in the research, development, manufacture, and sale of street, traffic, flood, and other outdoor lighting products. Floor space of the office, plant, and laboratory facilities will total about 200,000 sq ft. The plant is expected to be completed in 1956.

L. Byron Cherry, general manager of GE's Outdoor Lighting Department, will make his headquarters at the new plant.

Participating in the ground-breaking ceremonies, North Carolina's Gov Luther H. Hodges said, "We are gathered here today to welcome a new neighbor. General Electric is not a stranger in North Carolina. They have already invested, prior to this ground-breaking, millions of dollars in three other plant locations (Ashboro, Goldsboro, and Hickory) in North Carolina which provide employment for some 2,500 people."

In the ceremony the progress of one of man's earliest forms of lighting to today's electrical wonders was dramatized. A pine-heart torch was lighted from the age-old "Eternal Flame" of the Cherokee Indians in North Carolina's Great Smokies. It was delivered by Richard Crowe to L. Byron Cherry, general manager. He in turn gave the torch to Governor Hodges who passed the torch near a photo-electrical cell which energized a green light. This light signalled the start of bulldozing operations.

## A-C Sets Up Industry Application Section

Formation of an industry application section headed by B. G. Witty has been announced by R. M. Casper, manager of the power department of Allis-Chalmers general machinery division. T. B. Montgomery is chief engineer of the section.

The section will have the responsibility of processing inquiries, handling commercial matters and application engineering of general machinery division products normally sold as a related operating group of equipment, such as steel and brass mill drives.

## Sangamo to Produce Radio Equipment

Sangamo Electric Co of Springfield, Ill, has acquired the assets of the Gothard Manufacturing Co, also of Springfield. The latter will operate under the name of Sangamo Generators, Inc, at 2110 Clear Lake Ave, Springfield, Ill. Officers and directors are all officials of the Sangamo Electric Co.

Products are converters, inverters, dynamotors, small generators, and dc motors for mobile radio equipment; also frequency changers 400 cps to dc and reverse, and 5 kw gasoline-engine driven power plants. The equipments will be produced under the Sangamo name.

## Sylvania Establishes Electronic Systems Div.

Sylvania Electric Products Inc has established an Electronic Systems Division, the company's ninth operating division. Currently the active projects involve such fields as communications, analogue and digital computer systems, detection devices, radar, and test equipment for electronic devices.

Arthur L. Chapman, vice president-operations, announced appointment of Henry Lehne as general manager of the new division. Norman L. Harvey will serve as assistant general manager and chief engineer.

Headquarters of the Electronics

Systems Division will be at 175 Great Arrow Avenue, Buffalo, N. Y. The division also maintains the Electronics Defense Laboratory at Mountain View, Calif., and an engineering laboratory in Boston, Mass. This latter will be moved to the new laboratory in Waltham, Mass., which is expected to be completed in March 1955.

## Aluminized Wire

Aluminum coated wire designated ACCO aluminized wire will be in large scale production late in 1955, according to E. B. Brant, production manager, Page Steel & Wire Division of American Chain & Cable Co. The hot-dip aluminum coated iron and steel wires in 3-wire and 7-wire strand are being manufactured in a pilot plant. (EW, July 26, 1954, p. 130). Aluminum wires may be stranded over aluminum coated steel wire cores and used for transmission and distribution systems. Other applications of the aluminized wire are chain link fences, communication and signal systems.

## Penn Center Building Has I-T-E and BullDog Units

First building in the Penn Center development, and reportedly the first large office building erected in Philadelphia in more than two decades, has major electrical distribution equipment furnished by the I-T-E Circuit Breaker Co and its subsidiary the BullDog Electric Products Co. This 20-story building has an area of approximately 26,000 sq ft per floor, is completely air conditioned and is expected to be ready for occupancy by April 1.

The two incoming 13.8-kv service lines from the utility are protected by 150 Mva magnetic air circuit breakers. The lines are controlled by automatic transfer equipment against loss of voltage on either supply source. Metering is incorporated in the 13.8-kv switchgear assembly.

Dual unit substation assemblies are equipped with two 1,500-kva transformers. One substation provides 120/208-v, 3-ph, 4-w service for lighting, and the other substation provides 480-v, 3-ph, 3-w service for power.

Bus duct risers for the 20 floors and distribution panelboards on each floor complete a metal clad assembly from basement to roof.

## Reynolds Installs Two Large Reduction Cells

Reynolds Metals Co reports that the largest reduction cell operated in a commercial line producing primary aluminum is used in two recently built reduction plants. These two facilities are San Patricia plant, near Corpus Christi, Texas, with a rated capacity of 160 million lb of aluminum per year, and the Robert P. Patterson plant at Arkadelphia, Ark., with a capacity of 110 million lb yearly.

The cell is known as the Soederberg type. Power source for each installation must have a dc capacity of approximately 100 Mw. Aluminum bus bars with cross-sectional area of over 500 sq in. and capable of carrying over 125,000 amp are required to carry the electric power to and from the cell.

## MANUFACTURING BRIEFS

**Pelton Water Wheel Co** of San Francisco will furnish 14 main turbine governors and two fish turbine governors for the Dalles dam powerhouse. Award of the $1,078,056 contract was authorized by Secretary of the Army to Chief of the Army Engineers.

**R. E. Mattison & Co** of Oklahoma City, Okla, was successful low bidder of six firms on 31 miles of transmission line for the Black Hills Power & Light Co, Rapid City, S.D. Major portion of construction will be 24 miles of 69-kv line. Other seven miles will be a 12-kv line to replace an existing line. Construction is expected to start in late February and completion is anticipated in May.

**General Electric Co** Small Integral Motor Dept. has a transition polyphase motor line in the 1 to 5-hp range. Although built in the old NEMA frame sizes and available at premium prices, the motors will incorporate the features of the new Tri-Clad 55 motor . . . The Locke Dept at Baltimore has announced the withdrawal of pole-line hardware from its product scope. G. A. Goddard, Manager-Marketing, states the Department will concentrate on porcelain insulators, their associated line hardware and apparatus bushings.

**Westinghouse Items**

- Public Service Co of Oklahoma has ordered two 125,000 kw, outdoor-type turbine generators with inner-cooled windings, Thermolastic insulation, and condensers for installation in Tulsa, Oklahoma; first unit to be shipped in December 1955, the second in December 1957.
- An "electric governor," utilizing the magnetic amplifier, to control output of engine-driven generators has been developed jointly by the company and the U. S. Army Corps of Engineers. It will be built at Buffalo, N. Y., according to Tom Turner, Westinghouse vice president.
- "With the completion of a four-story addition to our plant here (Mansfield, Ohio) we have finished the first phase of an expansion program ($2.5 million) designed to approximately double our production capacity of ranges, Laundromat automatic washers, clothes dryers, dishwashers and water heaters, as well as to substantially increase our production capacity of portable appliances," stated J. H. Ashbaugh, vice president of the Electric Appliance Division plant at Mansfield.
- A beginning has been made to "fair trade" portable appliances at the wholesale level, according to R. M. Oliver, manager of portable appliances.

**NAM**—National Association of Manufacturers with offices at 2 East 48 St, New York 17, N. Y., has issued a two-color, 24-page booklet, entitled "Calling All Jobs." The book stresses the fact that industrial machinery has undergone a continuous process of improvement and uses historical examples. It is designed to end the fears caused by the word "automation" which means to some employees that mechanical robots will supplant them and leave them jobless.

## SALES ASSIGNMENTS

### COMPANY STAFFS

**Bristol Co,** Waterbury, Conn., has appointed Alden H. Webber to the position of field sales engineer for the Seattle, Wash., area with headquarters in that city. Webber has been with the company since 1943.

**Federal Pacific Electric Co,** Newark, N. J., has named Harry Knudson manager of the Middle Atlantic sales region with headquarters in Newark. With Federal Pacific since 1946, Knudson most recently was manager of the combined Philadelphia and Newark sales districts. Before joining the firm, he was associated with Philadelphia Electric Co.

**Kuhlman Electric Co,** Bay City, Mich., has made Walter H. Thompson sales manager of its Western Transformer Division with offices at 870 Tennessee St., San Francisco. Thompson, who has had many years experience in contacting electrical utilities in the West, will represent Kuhlman in the 11 Western states and the El Paso area of Texas.

**Chase Brass & Copper Co,** Waterbury, Conn., has announced these major changes in assignments of sales personnel. A. Reece Hooks, Jr, who has been salesman in the Chase Atlanta district since 1948, succeds Herman H. Herring as district manager at Atlanta, while Herring is transferred to New Orleans. Joseph M. Jolley, a salesman in New Orleans for a number of years, replaces John M. Gehl, Jr, as district manager in New Orleans. Gehl now will devote his full time to his responsibilities as Southern regional manager, supervising Chase district sales offices and warehouses in Houston, Dallas, Atlanta, and New Orleans. Chase has also established a new district sales office in Charlotte, N. C., to service most of North and South Carolina. Herman H. Kremer, formerly with the Indianapolis, Ind., Chase sales district has been appointed district manager. This new district will be under general supervision of Gehl.

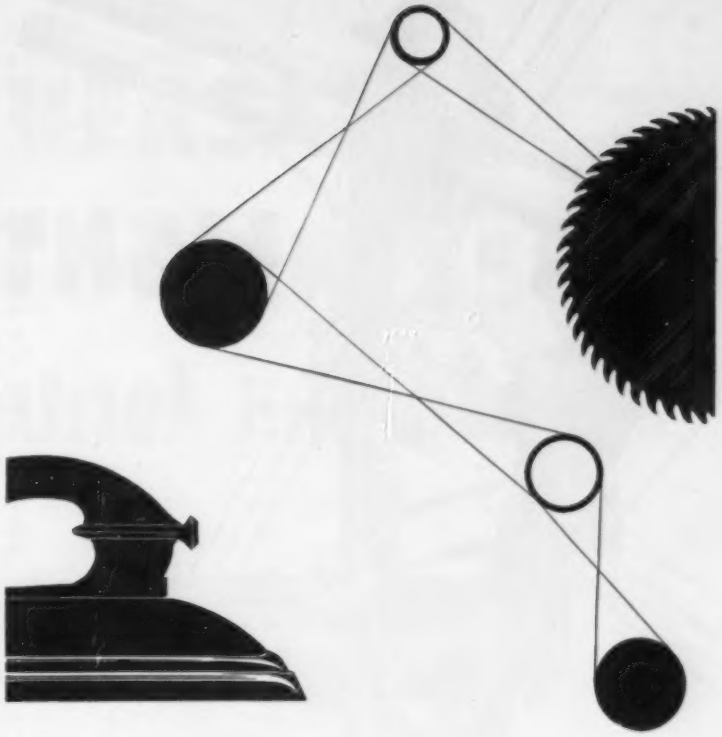
**Stone & Webster Engineering Corp** has appointed Franklin C. MacKrell, a vice president of the firm, to the post of district manager in charge of its Chicago office. MacKrell, who assumed the vice presidency in 1949, will develop new business opportunities and will maintain close contacts with the firm's activities and clients in the Chicago and Midwestern areas.

**Delta-Star Electric Division** of H. K. Porter Co, Inc, has appointed James Kelso, Jr, field representative in Boston to take over the territory in the New England States. Kelso, formerly an application engineer for Allis-Chalmers Manufacturing Co in its Boston office, will be located at the Little Bldg in Boston.

**A. M. Castle & Co,** Chicago, has promoted Laird H. Hansen to Chicago district sales manager. Hansen, who started with the company in 1946, has been assistant sales manager in that district since January, 1952.

### REPRESENTATIVES

**Electric Controller & Manufacturing Co,** Cleveland, has designated Promociones Industriales, S. A., of Monterrey, as sales representative for all Mexico except the State of Sonora. This latter area will be served by EC&M's Los Angeles office, under the direction of J. R. Woodruff.

# UTILITY
## *means Useful*

Public utilities are indeed well named—and through both expansion and research America's utility companies are making their service still *more useful*, in more ways, to more and more people all the time. Utility expansion and research require sound financing. It is in this connection that Guaranty Trust Company has demonstrated its own usefulness to the utility industry for many years.

The officers of our Public Utilities Division put at the disposal of utility executives a thorough knowledge of utility financing in all its phases.

## Guaranty Trust Company of New York *Capital Funds $395,000,000*

140 Broadway, New York 15

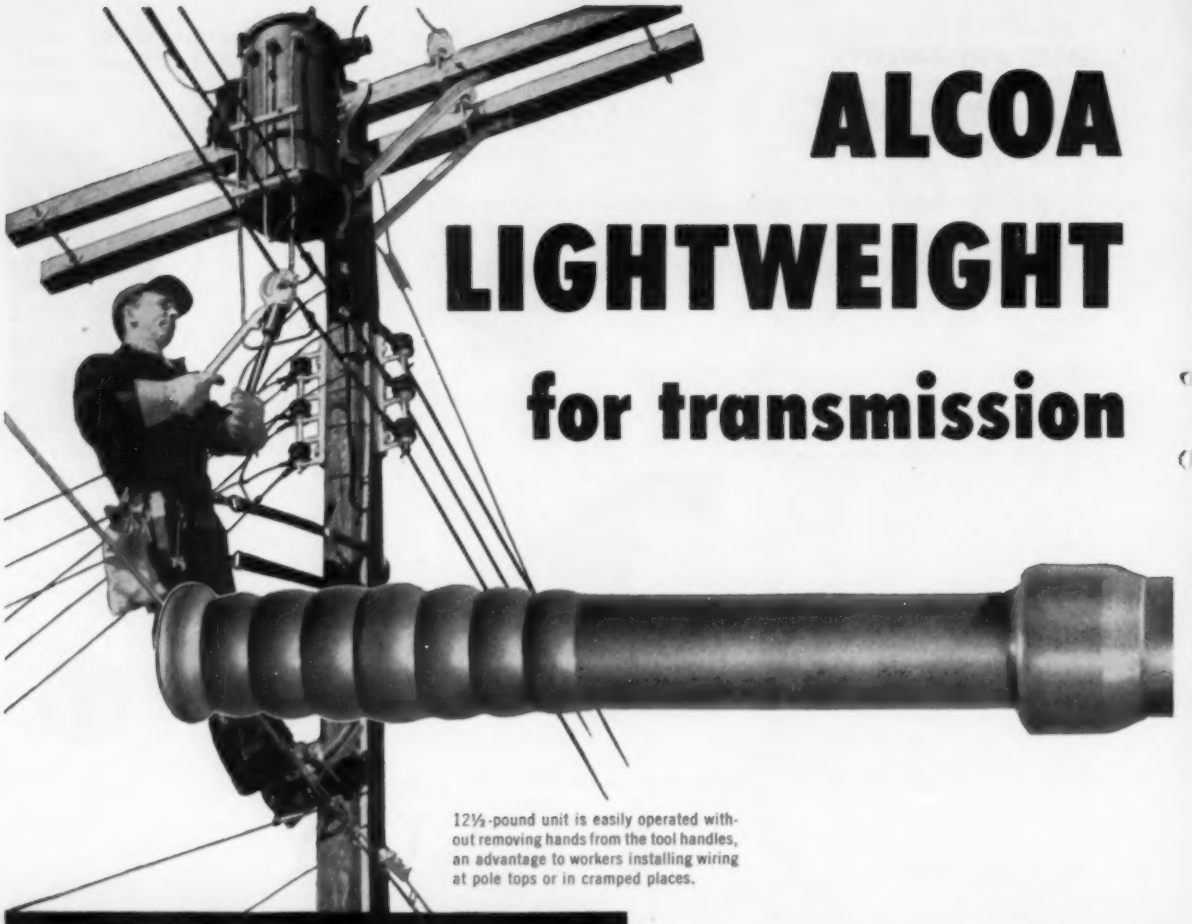
Fifth Ave. at 44th St. New York 36 · Madison Ave. at 60th St. New York 21 · 40 Rockefeller Plaza New York 20

LONDON: 32 Lombard St., E.C. 3 · Bush House, Aldwych, W.C. 2

PARIS: 4 Place de la Concorde BRUSSELS: 27 Avenue des Arts

*Member Federal Deposit Insurance Corporation*

# ALCOA LIGHTWEIGHT for transmission



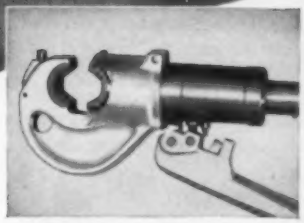
12½-pound unit is easily operated without removing hands from the tool handles, an advantage to workers installing wiring at pole tops or in cramped places.

Latest addition to most complete line of aluminum conductors and accessories continues Alcoa's leadership in the field!

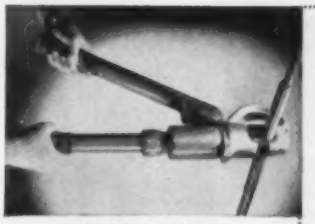
Model 12A compressor has 12-ton thrust for use on ACSR and aluminum conductors as large as 397,500 cm.

# OFFERS VERSATILE 12-TON COMPRESSOR

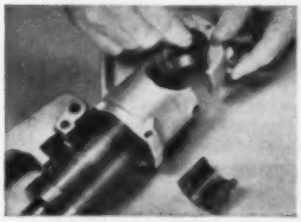
## and distribution line fittings



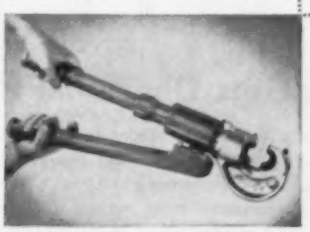
C-head holds dies, can be rotated 180° to facilitate easy operation by lineman in limited working space. Hand line may be easily attached to compressor.



Die opening is quickly closed by simple twist of one handle. Minimum effort completes compression stroke. Pressure release trigger, located at grip, automatically retracts dies.



Identical half dies are held in place by tool's head so compressor can be moved along the compression fitting without shifting of dies.



Other features are nylon pump packing, integral pressure relief valve. Normally supplied with neoprene covered body and handles, compressor may be adapted to "hot-stick" work.

Aluminum Company of America
2100-P Alcoa Building
Pittsburgh 19, Pa.

Please send copy of your Fact Folder on Alcoa Model 12A Compressor.

Name_____

Company_____

Street_____

City_____ Zone____ State_____

**ALCOA ALUMINUM**

ALUMINUM COMPANY OF AMERICA

# NEWS ABOUT PEOPLE

## Taylor Heads Wisconsin PS

The election of Harold P. Taylor, senior vice president and treasurer of Wisconsin Public Service Corp, has been announced by Leo T. Crowley, chairman of the board of directors. Taylor succeeds Charles E. Kohlhepp, who has resigned, effective April 1, to assume the presidency of Jersey Central Power & Light Co (EW, Feb. 14, p 43).

Wisconsin Public Service also revealed the appointment of L. G. Roemer to the post of treasurer. Roemer, who has been with the utility 25 years, formerly served as assistant treasurer.

Taylor joined the utility in 1925 at Green Bay where he was division auditor. Five years later he moved to Milwaukee as assistant treasurer. He was elected treasurer in 1938, vice president and treasurer in 1944, a director in 1952, and senior vice president in 1954.

He has been active in Edison Electric Institute and is currently president of Wisconsin Utilities Association.

HAROLD P. TAYLOR

## Stark Named Commercial VP

Federal Pacific Electric Co has elected William M. Stark as commercial vice president. In addition to his new responsibilities, Stark will continue in his present capacity as manager of Federal Pacific's Central sales region. His offices are located in regional headquarters at St. Louis, Mo. Stark joined the Federal organization in 1944 when that company purchased the Johns-Pratt Division of the Colt Patent Firearms Manufacturing Co. He had been an electrical specialty salesman for Johns-Pratt since 1920.

W. M. STARK

## Mitchell Appointed a VP

Ralph Mitchell, Jr, was elected a vice president of Central Transformer Corp, Pine Bluff, Ark., at a recent meeting of the company's board of directors.

The newly elevated official has been serving Central Transformer as its sales manager for the last two years. As vice president he will continue to be in charge of sales.

R. MITCHELL, JR

## Broomell Is Chief Engineer

G. L. BROOMELL, JR

G. Lupton Broomell, Jr, has been named chief engineer of Leeds & Northrup Co. He joined L&H in 1937, becoming successively head of the recorder development section, and assistant chief engineer.

Broomell has been active in American Standards Association and American Institute of Electrical Engineers.

## Donworth Gets Divisional Post

Robert B. Donworth has been placed in charge of Duquesne Light Co's Engineering and Construction Division. With Duquesne Light since 1930, Donworth was made manager of the company's Atomic Power Development Department in 1953. He has supervised atomic studies of the company and has participated in Duquesne's nuclear reactor work in connection with the construction of the nation's first full-scale atomic power plant at Shippingport, Pa.

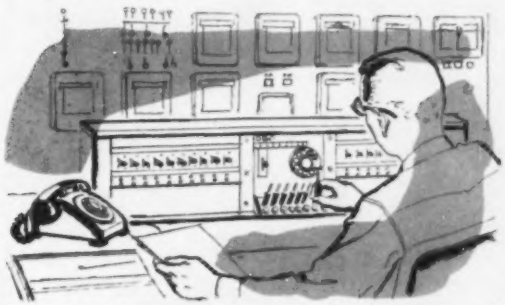
R. B. DONWORTH

# 6 ways to save money in communications

If you want to save money and, at the same time, increase efficiency, let the Bell System furnish your communications. To get the facts, Bell System engineers will gladly make a joint review with your people. Ask your Bell telephone representative for more information.

**BELL SYSTEM GIVES YOU COMMUNICATIONS AT LOW COST**

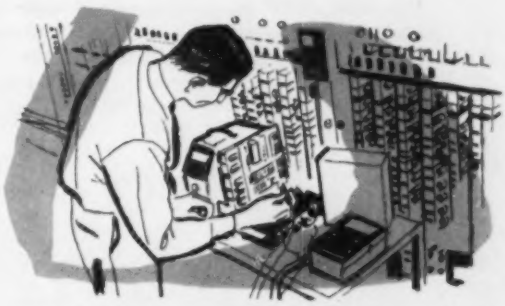
**TAILORED COMMUNICATIONS**—Bell System engineers fit your communications to your needs. You get precisely what you require. No more, no less.



**FLEXIBLE COMMUNICATIONS**—Designed to meet your exact requirements, Bell System communications may be expanded or rearranged to match the changing needs of your business.

**NEWEST EQUIPMENT**—The latest developments in communications equipment are available to keep your service at peak efficiency without investment of your capital.

**ROUNDED EXPERIENCE**—You benefit from years of Bell System experience with specialists in all phases of communications.



**RELIABLE MAINTENANCE**—You are relieved of repair and replacement worries. And Bell System preventive maintenance insures that your communications stay reliable.

**YOUR MONEY** is available to invest in revenue-producing projects, not tied up in communications equipment. A fixed monthly charge covers your exact needs.

BELL TELEPHONE SYSTEM

TELEPHONE MOBILE RADIO TELETYPEWRITER INTERCOMMUNICATION AND PAGING SYSTEMS TELEMETERING AND REMOTE CONTROL

# Schilling Elected President of Iowa Group

New officers for 1955 were announced by Iowa Utilities Association at the annual directors' meeting held recently in Des Moines, Iowa.

The association's new president will be J. T. Schilling, executive vice president of Iowa Power & Light Co, Des Moines. Schilling, who previously served the organization as vice president, succeeds Paul L. Mercer of Union Electric Co, located at Keokuk.

J. T. SCHILLING

Other officers elected by the association for 1955 include: First vice president, C. P. Conrad, Iowa-Illinois Gas & Electric Co, Davenport, and second vice president, L. G. Hawkins, Peoples' Gas & Electric, Mason City.

Ben A. Webster was reelected as executive secretary of the association and Carroll E. Worlan was appointed assistant to the executive secretary.

# Silverman Heads Research Dept.

Promotion of Dr Joseph Silverman to head the Research Department of its Laboratory Division has been disclosed by Walter Kidde Nuclear Laboratories, Inc. Dr Silverman joined the Laboratories as staff physical chemist when the company was established two years ago. Previously he was affiliated with the Atomic Energy Division of the H. K. Ferguson Co.

JOSEPH SILVERMAN

## PERSONAL BRIEFS

**John G. Miller** has been appointed assistant chief engineer of Metropolitan Edison Co. Besides retaining the duties of his former position of superintendent of production in charge of operation and mechanical design of power stations, Miller will assist in directing engineering functions relating to planning, design and operation of MECO's entire electrical system. **C. H. Leatham** has retired as executive vice president of Monongahela Power Co. Leatham, whose retirement ends a 46-year utility career, joined Monongahela in 1935, advancing to the present post in 1950. **Stewart G. Stalnecker,** assistant treasurer of Public Service Electric & Gas Co, has been named treasurer to replace **T. Wilson Van Middlesworth,** retired. Stalnecker's successor is **Edward M. Forus,** director of educational work. **Edward W. Hodgetts,** assistant manager of the electric sales department of Cincinnati Gas & Electric Co, has been named director of promotion. In addition, **George J. Kuehnle, Jr,** manager of the Northern Division, was made director of community relations. Replacing Kuehnle will be **William K. Robinson,** industrial development representative.

**Earl F. Boyle** has been elected vice president of Johns-Manville and vice president, general manager, and a member of the board of directors of Van Cleef Brothers, Inc, wholly owned subsidiary of Johns-Manville. He has been with the company for 38 years.

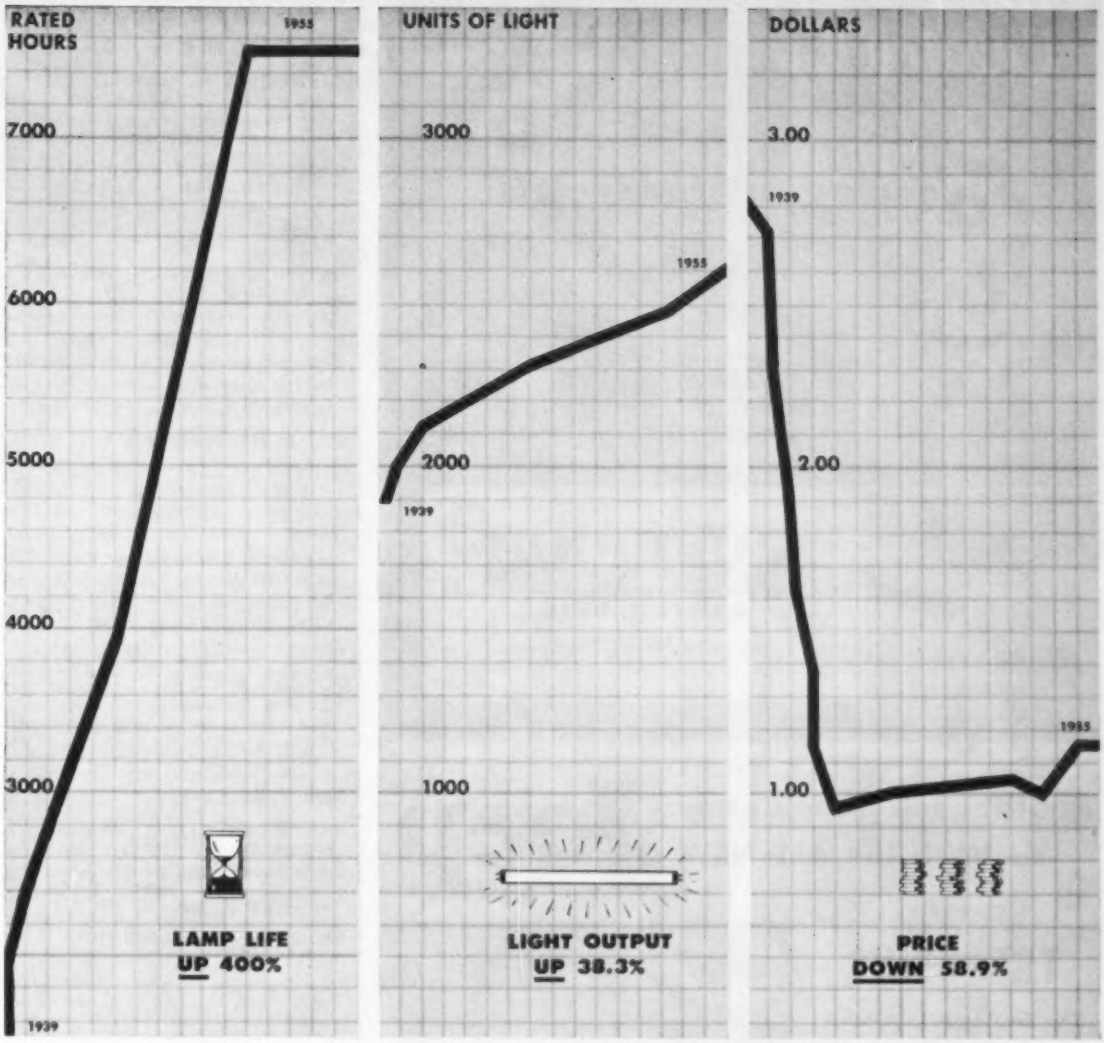
## OBITUARY

**James Bennan,** 44, president and chairman of the board of Jefferson Electric Co, Bellwood, Ill., died February 9. Bennan started with Jefferson Electric in 1933 as a production control clerk. He was serving as executive vice president of the firm when he assumed the presidency in 1949. Bennan was a son of the late John A. Bennan, one of the founders of Jefferson Electric and its first president.

**Philip K. Fletcher,** 65, retired president and general manger of the Alpena (Mich.) Power Co, died there recently. He retired in 1952 after serving as president of the utility for 30 years.

**Joel H. Berry,** 66, retired district manager of Virginia Electric & Power Co in Norfolk, died Feb. 5.

YOU EXPECT THE BEST VALUE FROM G-E FLUORESCENT LAMPS




# 16 times more value for your fluorescent lamp dollar than in 1939

Today you don't have to pay more than $1.15 for the finest fluorescent lamp made: General Electric. Sixteen years ago it would have cost you $2.80 or $1.65 more. And while price has been going down, we've been pushing quality up. General Electric has upped light output 38%, increased lamp life 400%.

In terms of what you really judge lamps by, a General Electric 40-watt fluorescent lamp that lists at $1.15 today is a *16-times bigger value than it was in 1939.*

For further information, contact your G-E lamp supplier or write to Lamp Division, General Electric, Department 166-EW-2, Cleveland 12, Ohio.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

Another Job Done Better With The ALL-NEW 'Jeep'®

TRENCHING

This 'Jeep'-propelled trencher digs trenches up to 5 feet deep at the rate of 300 feet an hour. Mounted on the 'Jeep' and powered by its *Hurricane* Engine, it gets to the job in a hurry, speeds up the laying of pipe, cable or drain tile. Traveling at road speeds to the job, the unit is ready for trenching in a matter of minutes. Greater mobility makes the 'Jeep' trencher profitable for short runs of trench. It will pay you to investigate all the time-saving advantages of the 4-Wheel-Drive Universal 'Jeep'.

WILLYS MOTORS, INC.
TOLEDO 1, OHIO

The 'Jeep' Family of 4-Wheel-Drive Vehicles . . . UNIVERSAL 'JEEP' • TRUCK • STATION WAGON • PANEL DELIVERY

THE WORLD'S MOST USEFUL VEHICLES


# MEETINGS

## Week of Feb. 20-26

**CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION**
24th Annual Conference, Hotel Senator, Sacramento, Feb. 22-25.

**PACIFIC COAST ELECTRICAL ASSOCIATION**
Conference on Electronic Integrated Data Processing, Hotel Statler, Los Angeles, Feb. 23-24.

**NATIONAL ADEQUATE WIRING BUREAU**
11th Annual Conference, La Salle Hotel, Chicago, Feb. 24-25.

**PENNSYLVANIA ELECTRIC ASSN.**
Systems Operation Committee, Abraham Lincoln Hotel, Reading, Pa., Feb. 24-25.

## Week of Feb. 27-March 5

**SOUTHERN SAFETY CONFERENCE-EXPOSITION**
Jung Hotel, New Orleans, La., Feb. 27-March 1.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS**
1st International Congress on Air Pollution, Hotel Statler, New York, March 1-2.

**EDISON ELECTRIC INSTITUTE**
1st Street Tree and Utility Conference, co-sponsored by EEI Transmission and Distribution Committee, Street Lighting Committee of Illuminating Engineering Society and National Shade Tree Conference, Wade Park Manor, Cleveland, March 3-4.

## Week of March 6-12

**NORTH CENTRAL ELECTRICAL LEAGUE**
18th Annual Upper Midwest Electrical Industry Convention, Radisson Hotel, Minneapolis, Minn., March 6-9.

**PACIFIC COAST ELECTRICAL ASSOCIATION**
Engineering and Operating Section Conference, Hotel Huntington, Pasadena, Calif., March 7-8.

**NATIONAL ASSOCIATION OF CORROSION ENGINEERS**
Annual Convention, Palmer House, Chicago, March 7-11.

**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS**
Farm Electrification Conference, Morrison Hotel, Chicago, March 8-10.

## *Week of March 13-19

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION**
Edgewater Beach Hotel, Chicago, March 13-18.

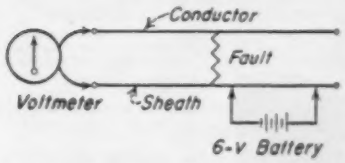
**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS**
Utilization of Aluminum Conference, William Penn Hotel, Pittsburgh, March 15-17.

**EDISON ELECTRIC INSTITUTE**
Industrial Relations Committee, EEI Headquarters, New York, March 17.

*Additions this week.

## Pin Pointing Faults

(*Continued from page* 113)




**"SHEATH DROP" METHOD shows case where voltage drop is not measured by the meter**

sulation clear of the fault. The gap thus created provides an arcing path for the discharge which is an ideal source of the required vibration.

Ability of the discharge to blast carbon clear of the fault depends on the condition of the cable sheath, i.e., punctured or closed. Ninety-five per cent of all troubles result from sheath punctures which allow carbon expulsion. They are easily located with the stethoscope. The remaining faults do not involve sheath punctures and seldom provide a discernible vibration. They are generally located within splices that have absorbed moisture.

Location of faults that maintain low-resistance is accomplished by the "sheath drop" method. This scheme is also used to sectionalize unusually long cables, thereby minimizing patrolling time with the stethoscope.

Operation with this method can best be understood by referring to the above illustration. Current from a battery is passed through a short length of the lead sheath, and the resulting voltage drop is measured between the conductor and sheath at one terminal of the faulted section. If the fault is between the metered terminal and the "sheath drop," as shown, a voltage will not be measured. Conversely, a reading will be obtained when the fault is beyond the "sheath drop." Using this principle, faults are localized by the normal "halving process." This procedure eliminates unnecessary opening of the cable.

A standard 6-v storage battery is used with leads cut to a length that limits the current to 50 amp. A vacuum tube voltmeter is ideally suited as it provides great sensitivity, and readings obtained are not functions of fault resistance. Experience indicates, however, that a 0-100-microamp dc meter is quite adequate

(*Continued on page* 188)

PAGE chain link FENCE
America's First Wire Fence—since 1883

• Security against the ever-present hazards that can damage or destroy property, or injure persons, is a responsibility to assign to PAGE Fence. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

*Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

Another Job Done Better With The ALL-NEW 'Jeep'®

BACKFILLING

Equipped with a hydraulically-controlled blade, the 'Jeep' is an efficient backfiller. Shown here is a blade mounted on a 'Jeep' trencher—a single power unit that does both trenching and backfilling. Get details at your 'Jeep' dealer.

WILLYS MOTORS, INC.
TOLEDO 1, OHIO

The Jeep' Family of 4-Wheel-Drive Vehicles . . . UNIVERSAL 'JEEP' • TRUCK • STATION WAGON • PANEL DELIVERY

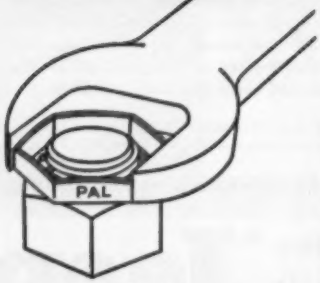
THE WORLD'S MOST USEFUL VEHICLES

Simple, low cost way

TO KEEP NUTS TIGHT

Spin on a PALNUT LOCK NUT

LOCK IT *in seconds...*
FORGET IT *for years*




**Whether you build equipment, or buy equipment, specify PALNUT Lock Nuts to assure tight assemblies for the life of your equipment. Cut down troubles — reduce maintenance — improve operating characteristics.**

**PALNUT Lock Nuts cost little, apply fast, exert a double locking spring action that prevents nut from loosening and bolt from backing out. Require only 3 bolt threads. Easily removed and re-used when servicing.**

**Widely used in Utility field**

**PALNUT Lock Nuts have been used for years on wood pole, steel towers, fittings, connectors, switches, hardware, transformers, etc. Parkerized and hot dip galvanized steel; also silicon bronze. Get Bulletin #577 and samples.**

**THE PALNUT COMPANY**

**51 Cordier St.**
**Irvington 11, N. J.**

**PALNUT**
TRADE MARK
**LOCK NUTS**
for quick, secure fastening at low cost


## Pin Pointing Faults

(*Continued from page* 187)

for most jobs.

Over 200 plowed circuit faults on the Baltimore system have been located with the methods described, 95% of them with the stethoscope and impulse generator. The average fault was located in 15 minutes, resulting in a 50% cost saving over the former method of using a Wheatstone bridge.

## Aluminum for Towers

(*Continued from page* 113)

the average aluminum tower takes about 900 man-hr in contrast with 2,100 man-hr for the equivalent steel tower, a saving of 57%. Ease and safety of access and optimum working safety during inspection and maintenance operations indicate lower maintenance costs on aluminum towers, and its freedom from corrosion augurs substantially lower maintenance costs over the life of the tower. The smooth streamlined shapes accumulate less snow, grime, and ice, and the consequent lighter loading should be reflected in lower maintenance costs.

**Field Checks . . .** Erection was completed in the fall of 1953, and conductors were strung in the summer and fall of 1954. During the 1953-54 winter, an engineering crew recorded weather conditions and observations on the structures. In general, the few faulty members were confined to welds in the guardrails around manholes at the tops of the tower legs and partially defective leg section joint rings, the latter trouble being traced to faulty fabrication.

## Final NENYIAC Hearing

Final public hearing scheduled by New England-New York Inter-Agency Committee on hydroelectric and allied resources of seven northeastern states will be held at Boston on 10 a.m. March 10. The hearing will be conducted in main conference room of Massachusetts Department of Public Works, 100 Nashua St. Summation of comprehensive investigation made by NENYIAC will be presented. Hearings on the committee's findings have been held in states covered by the study.


## ELECTRIC TRANSMISSION AND DISTRIBUTION

**Describes simply and clearly the equipment used in transmission and distribution of electric energy** from generating station to consumer including overhead and underground circuits, high and low voltage circuits, protection against short circuits and lightning, and street lighting. Explains actual layout of equipment and what it does in the system. **Prepared by specialists under editorship of B. G. A. Skrotzki, Assoc. Ed., POWER.** 448 pp., 291 illus., $7.50

*JUST OUT!*

## ELECTRIC SYSTEM OPERATION

***Just Published!***

**Describes in detail the operation of generating, transmitting, and distribution equipment** covering the major problems in running an electric system safely and economically. Reviews electric utility system from fuel input and water flow to customer's connections. Shows operations involved in scheduling and maintaining equipment. Gives data on relays, load dispatching and control, system communications, operating costs and rate schedules, etc. **Prepared by specialists under editorship of B. G. A. Skrotzki, Assoc. Ed. POWER.** 370 pp., 278 illus., $6.50

## LIGHTNING PROTECTION FOR ELECTRIC SYSTEMS

**Practical guide to protection against lightning of electric systems and equipment.** Shows nature and effects of lightning, particularly for ac systems and apparatus, how to select and apply arresters, what conditions to look for to avoid trouble. Simple treatment holds mathematics to a minimum. Includes practical recommendations for protective measures, information on grounding, shielding by rods, masts, shield wires, uses, performance, and construction of arresters. **By E. Beck, Mgr. Lightning Arrester Section, Westinghouse,** 310 pp., 145 illus., $6.50

## LAMPS FOR A BRIGHTER AMERICA

**A HISTORY OF THE GENERAL ELECTRIC LAMP BUSINESS**

***Just Published!*** Tells the story of the miracle of modern lighting in a history of the G. E. lamp business. Closely following the growth of General Electric, along with the industry, the book gives a picture of the scientists and of the progressive research, technical achievement, and management efforts that contributed to the development of today's high standards of lighting. **By P. Keating,** 246 pp., 40 illus., $4.00

**FREE** 10 DAY EXAMINATION
MAIL COUPON BELOW

**McGraw-Hill Book Co., Inc., Dept. W-2-21**
**330 W. 42 St., NYC 36**

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if you remit with this coupon—same return privilege.)

- ☐ Skrotzki—**Electric Transmission and Distribution**—$7.50
- ☐ Skrotzki—**Electric System Operation**—$6.50
- ☐ Beck—**Lightning Protection for Electric Systems**—$6.50
- ☐ Keating—**Lamps for a Brighter America**—$4.00

(PRINT)

Name .....

Address .....

City ..... Zone ... State .....

Company .....

Position .....

*For price and terms outside U. S., write McGraw-Hill Int'l., N.Y.C.* W-2-21

## AIEE MEETING REPORT

(*Continued from page* 103)

E. R. Ambrose, chairman of the Joint Association of Edison Illuminating Companies—Edison Electric Institute Heat Pump Committee. He put the blame on their high demand and low power factor. New methods are in the works now, he said, with studies underway on use of solar energy and on various kinds of heat storage systems using water, gravel, and steel.

This same contention was backed by C. G. Freyder, Commonwealth Edison Co, who expressed confidence in research and manufacturers' efforts to find something better.

TVA's William R. New, armed with a solid bundle of tables and charts, brought some brisk after-meeting comment with his study of electric house heating load characteristics. New, who is chief of the Authority's Special Studies Section, Division of Power Utilization, noted that every tenth home in the Tennessee Valley is now heated electrically.

Then, from data he had collected, he went on to make these conclusions:

- Where heating installations are engineered as to thermostatic control and the amount of connected load, approximately 50% of the installed heating will add to the peak system demand at design temperatures.
- The average diversified monthly load factor of the all-electric home will normally range from 45 to 50% with the annual load factors approximating 25%. This annual load factor should increase to 30-35% as air conditioning is added.
- An annual load factor of 25% produced by heating is not undesirable because of the small capacity of distribution facilities required.
- All of the energy uses in the house actually contribute to heating the home and thereby reduce the required connected heating load.
- Experience shows that distribution transformer loads of 200% of rated capacity are economical for the heating peaks.
- The evening peak on the all-electric home in TVA area has grown faster during the past several years than the morning peak; consequently, evening peaks are likely to equal the morning peaks thereby improving system load factors.

## AIEE MEETING REPORT

(*Continued on page* 190)


**acker** utility digger sets poles in minutes!

The new Acker Utility Digger makes short work of pole setting. Its lightweight, compact design performs perfectly in rugged open country or crowded city streets. The basic unit mounts on jeep or small truck with either self-contained or power take-off.

**LOOK** at some of the exclusive features of this moderately priced digger.

1. Built-in power hoist and sheave have a capacity of 1500 lbs.
2. High speed auger digs holes up to 20" in diameter and depths of 10 feet.
3. Completely self-contained unit with no extra accessories to buy.
4. Finger-tip hydraulic controls for easy, one man operation.
5. Speedy operation saves time and money.

For complete details, write for bulletin **40EW.**

**ACKER DRILL CO., INC.** 725 W. Lackawanna Avenue Scranton, Penna.

*a complete line of Soil Sampling Tools, Diamond and Shot Core Drills, Drilling Accessories and Equipment*

LOOK TO THE WORLD'S LEADER

**ELECTROMODE**

**All-Electric HEATERS**

HOME INDUSTRY FARM

For more than a quarter century Electromode has concentrated on one specific enterprise—Heating by Electricity. Continually expanding its line to serve modern heating methods, Electromode has the most complete selection of electric heaters and electric heating systems available today.

**SAFEST TO USE!**

Only Electromode has the completely sealed-in, cast-aluminum heating element. No danger of fire, shock or burn. Automatic safety switch prevents overheating. The heating element is guaranteed for five years against any defect in material or workmanship.

MODELS AND CAPACITIES FOR ALL REQUIREMENTS

**For the HOME**

Wall-Types and Portables
Radiant Panel Heater
Baseboard Heater
Ceiling Radiant Cable Heating

Wall-Type Down-Flo

**INDUSTRIAL UNITS**

Suspension-Type
Portable and Suspension
Explosion-Proof for hazardous areas

Suspension-Type

**For the FARM**

Milk House Heaters
Pump House Heaters

Milk House Heater

*Approved by Underwriters' Laboratories*

**MAIL COUPON**

Please send your FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating.

**ELECTROMODE CORPORATION**

DEPT. EW-25, 45 CROUCH STREET, ROCHESTER 3, N. Y.

We are interested in ☐ Home ☐ Industrial ☐ Farm

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

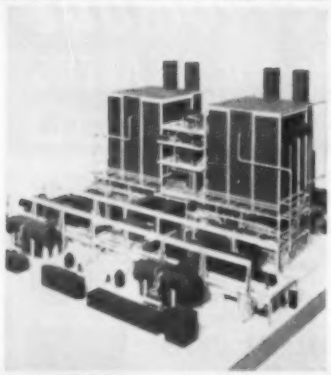
Keep Your Lines Clear

Sailors know the importance of "keeping the lines clear"—and so do we! We know it's costly and time-consuming to clear brush from transmission lines—by ordinary means. We use helicopters: it's quicker and cheaper; complete coverage insures optimum kill. Our patented brush-killer goes right to the roots. Contact us today—let us show you how we can "keep your lines clear" at less cost to you.

STULL'S
Chemicals

3400 Nacogdoches
P. O. Box 6722 San Antonio 9, Texas

Industrial Models Inc.



ADD 3-D TO YOUR DESIGN PICTURE

Industrial models help you see through construction and design problems before the blueprint stage. Save up to 30 times model cost by more efficient

- Equipment Arrangement
- Power Plant Layout
- Piping Arrangement
- Field Construction
- Personnel Training
- Maintenance Planning

Save time and effort, cut costs by putting Industrial Models' experienced engineers and craftsmen in your design picture. Write for detailed brochure.

2011 SEONSET RD., WILMINGTON 3, DEL.
• CLEVELAND • NEW YORK • THE HAGUE

 (*Continued from page* 189)

## Faster Ground Relays Cause False Trips

Many conditions of residual currents cause incorrect or undesired ground-relay operation, H. C. Barnes, American Gas & Electric Corp, and A. J. McConnell, General Electric Co, told the Relay section. Such false tripping is expected to increase if system expansion continues to demand faster ground-relay speed. Too high a sensitivity is one of the main causes.

Changes in operating practices will also be helpful. Reduced number of transformers operating with neutrals grounded at a terminal permits more uniform fault current distribution. More extensive use of high-speed reclosing minimizes effects of false tripping. Increased use of counterpoise and static wires and more extensive application of pilot wire or phase-comparison carrier would also help.

**Vibration Causes Misoperation . . .** Shock and vibration may cause relay misoperations, reported R. E. Cordray for a special project committee. To mitigate these, engineers should:

1. Use slate or composition panels.
2. Provide bracing for steel panels.
3. Use absorbing material between panels and foundations and between relays and panels.
4. Avoid mounting shock sensitive relays on steel doors.
5. Provide door checks to control speed of door opening and closing.

Shock resistance can also be improved by some relay modifications, such as improved backstop construction and increased restraining spring torque, air gap spacing, and contact gap spacing.

**Cables Measured for Carrier . . .** Difficulties in calculating carrier characteristics on power cables lead B. J. Sparlin, Westinghouse Electric Corp, and J. D. Moynihan, Sprague Electric Co, to develop an accurate means of measuring the characteristics. Phase impedances to cable sheath are measured for different frequencies with the remote end of the cable open and short circuited.

### Relay and Carrier Conclusions

- False tripping increases as system expansion forces faster ground-relay speed.
- Lower relay sensitivity will reduce incorrect operations.
- Elimination of shocks and vibrations will also insure correct relay functioning.
- Lack of exact information on power cables requires the measuring of carrier characteristics rather than computing them.

## Studies May Cut Shock Deaths

Studies of the effect of electricity on the heart hold promise that fewer lives will be lost from electrical shock, the Safety section was told. Investigations are keyed to find out what causes fibrillation of the heart, how to defibrillate the heart, and what equipment can be used in the field.

Fibrillation from electrical shock changes the normal pumping action of the heart into a twitching movement, and regular pulsations cease, said S. A. Talbot, Johns Hopkins Hospital. This change results from brief weak currents of 0.01 to 1.0 amp passing through the heart and occurs in 30 to 90% of shock cases, depending on strength and path of the current.

When fibrillation occurs artificial respiration is useless as blood is not circulating to carry oxygen. After two minutes without oxygen the heart

often fails to resume pumping even though fibrillation may be stopped by applying a current through the heart.

**Defibrillation . . .** The best method found to defibrillate a dog's heart by external means was a single application of 60-cps current lasting about one sec, said W. B. Kouwenhoven and W. R. Milnor, Johns Hopkins University. Most effective direction of flow was longitudinal, from head to foot.

For this series of tests current was applied by pressing 5 x 5-in. hand electrodes, which were smeared with cardiac jelly, at the necks and just below the floating ribs of 58 dogs. Four to 6.25 amp at 450 to 500 v, 60 cps was used.

Similar currents were applied to eight normal dogs to determine hazards of using resuscitating currents. In no case did injury occur after applying currents of one to two-sec durations.

Kouwenhoven emphasized that this method is not ready for field use. Other methods tried for defibrillating the heart but found unsatisfactory were the use of a capacitor discharge and pulses of alternating current.

**Special Generator Is Best . . .** Most practical source of power to be used in the field for defibrillation appears to be a separate engine-driven generator, said P. L. Betz, Consolidated Gas, Electric Light & Power Co of Baltimore. A suitable unit could cost about $700, weigh 450 lb, be mounted on wheels, and have a permanent-magnet generator driven by a gasoline engine.

## Safety Session Finds That:

- Currents from 0.01 to 1.0 amp passing through the heart cause fibrillation.
- Defibrillation is accomplished with counter-shock ac currents of about 5 amp passing through the heart.
- Normal heart pumping must resume within minutes or death may result.
- Chances of resuscitating current being successful after two minutes are one out of seven.


**Fold up your derrick from inside the cab!**

with the

**TEL-E-LECT STORAGE KIT**

The patented Storage Kit fits any standard utility truck body and "A" frame derrick and it can be quickly bolted on the back of your truck by your local mechanic. The derrick will go up or down in a minute or less, entirely controlled by the man in the truck cab. Working with a double drum winch, you get live boom operation—or easily adjustable derrick elevation with a single drum winch. The cost is only a fraction of other, more intricate derrick storing systems—and there's no rebuilding of your present equipment! *Write for details.*

*Earth Boring Equipment for All Types of Trucks*

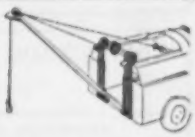
**TEL-E-LECT PRODUCTS, INC.**

10,003 Minnetonka Blvd., Minneapolis 16, Minn.

U.S. Patent No. 2,336,965.

Derrick raised by simply engaging the winch.

Vertical position—winch rotation reversed.



Derrick is locked in operating position.

**If . . . You Change Your Address**

Be sure to notify us at once so future copies of Electrical World will be delivered promptly.

Also make certain you advise your local Postmaster, so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

*Send your new and old address to: Subscription Dept.*

**ELECTRICAL WORLD**

330 W. 42nd St. New York 36, N. Y.

**Rush Aluminum Cable Brush Removes Oxide without Damaging Surface**

*For Positive Electrical Connection*

The Rush Aluminum Cable Brush consists of thousands of specially beaded glass fibers which surround the aluminum strands and remove surface oxide quickly, easily and without damage. Glass fibers are wound with tape which can be unwound as the fibers wear down, resulting in long service life.

*Guaranteed to Satisfy or Your Money Back. Order Today*

No. 145-11-1, 1" dia. x 6" long, $3.24 ea.
No. 145-11-2, ⅝" dia. x 6" long, $1.75 ea.

**THE ERASER CO., INC.** 1068 S. Clinton St., Syracuse 4, N. Y.

# PROFESSIONAL SERVICES

## HARZA ENGINEERING CO.
*Consulting Engineers*

Calvin V. Davis — E. Montford Pusik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street — Chicago 6

## CHAS. T. MAIN, INC.
*Engineers*

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

## BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## HOOSIER ENGINEERING COMPANY
*Erecting Engineers*

*Transmission Lines, Substations*

1384 Holly Avenue, Columbus, Ohio

## PIONEER SERVICE & ENGINEERING CO.

Consulting and Design Engineers . . Purchasing . . Specialists in Financing Accounting and Other Operations

231 So. La Salle St. — Chicago 4

## BLACK & VEATCH
*Consulting Engineers*

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuations and Rates

4706 Broadway — Kansas City 2, Missouri

## S. E. HUEY & CO.
*Engineers & Surveyors*

SURVEYS FOR ENGINEERS

Monroe — Louisiana

## Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES

THE ONE-STEP METHOD
**(exclusive with R&S)**

100 Sixth Ave. WOrth 6-2700 New York 13, N. Y.

## THEODORE D. BROSS & COMPANY

Steel Tower & Wood Transmission Lines
*Distribution & Maintenance*

175 Enfield St. — Hartford, Conn.

## JACKSON & MORELAND
*Engineers and Consultants*

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston — New York

## REIS & CHANDLER, INC.

ADVISORS TO UTILITIES

Financing—Rate of Return

30 Vesey Street, — New York 7, N. Y.

## DAY & ZIMMERMAN, INC.
*Engineers*

Design - Construction - Management
Investigations and Reports

New York — Philadelphia — Chicago

## M. W. KELLOGG
*Piping System Design Analyses*

Unique piping system model tester as well as modern IBM card programming computer available for low cost, accurate analyses of the most complex piping systems.

The M. W. Kellogg Company,
225 Broadway, New York 7, N. Y.

## SANDERSON & PORTER
*Engineers and Constructors*

*Reports and Surveys*

New York — New York

## Doble Engineering Company
*Electrical Insulation Engineers*

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

## THE KULJIAN CORPORATION
*Engineers - Constructors - Consultants*

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)

Utility • Industrial • Chemical

1200 N. Broad St., — Philadelphia 21, Pa.

## SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

## ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

## N. A. LOUGEE & COMPANY
*Engineers and Consultants*

REPORTS — APPRAISALS
DEPRECIATION STUDIES—RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway — New York

## F. W. SCHEIDENHELM
*Consulting Engineer*

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals

50 Church Street, — New York 7, N. Y.

## ROBERT E. FOLEY CONSTRUCTION CORPORATION

Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Grisold St. — Binghamton, N. Y.

## LUCAS & LUICK
*Engineers*

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

## F. A. TUCKER, INC.
*Contractors—Engineers*

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office—88½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N. C.

## FORD, BACON & DAVIS
*Engineers*

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

## THE LUMMUS COMPANY
*Engineers and Constructors*

385 Madison Ave., New York, N. Y.

Chicago . . Houston . . London
Paris . . The Hague . . Montreal
Caracas . . Bombay

## UTILITIES LINE CONSTRUCTION COMPANY, INC.
*Construction and Maintenance*

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road — Jenkintown, Pa.

## GILBERT ASSOCIATES, Inc.
*Engineers • Consultants • Constructors*

Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
Industrial Relations • Purchasing

New York — Philadelphia — Washington
Rome — Manila — Medellin

## LUTZ & MAY
*Consulting Engineers*

STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS — ELECTRIC SYSTEMS
REPORTS — DESIGN — APPRAISALS

1009 Baltimore — Kansas City 6, Mo.

## THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

# Advertising In This Issue


Acker Drill Co., Inc. ..... 189
Air Preheater Corp., The ..... 52
Allis-Chalmers Mfg. Co....2nd Cover
24, 25, 38, 39, 57, 65, 81
Aluminum Co. of America...180, 181
American Steel & Wire Div., United States Steel Corp....58, 59
American Telephone & Telegraph Co. ..... 183
Anaconda Wire & Cable Co..... 55
Anderson Brass Works, Inc..... 41

Babcock & Wilcox Co., The..36, 37
Blackburn Corp., Jasper..... 56
Blaw-Knox Co., Power Piping & Sprinkler Div. ..... 131
Brewer-Titchener Corp., The.... 67
Buffalo Forge Co..... 176
Burndy Engineering Co., Inc.... 9

Campbell Specialty Co..... 8
Chance Co., A. B.....69, 159
Chase Brass & Copper Co..... 80
Cole Electric Co..... 204
Collins Radio Co..... 15
Cope Inc., T. J.....26, 27
Copperweld Steel Co..... 51
Cornell-Dubilier Electric Corp.... 132
133
Crescent Tool Co..... 201
Crouse-Hinds Co..... 68

Delta-Star Electric Div., H. K. Porter Co., Inc.....150, 151
Diamond Power Specialty Corp... 169
Directory of Engineers ..... 192
Dossert Mfg. Corp. ..... 147
du Pont de Nemours & Co., (Inc.)
E. I., Polychemicals Dept..... 45
Rubber Chemicals Div..... 77

Eastern Specialty Co..... 152
Ebasco Services, Inc..... 40
Electric Service Mfg. Co.....74, 75
Electrical Mfg. Co..... 134
Electroline Company ..... 5
Electromode Corp. ..... 189
Electro Motive Div. General Motors Div. ..... 32
Elliott Co. ..... 155
Engineers, Directory of..... 192
Eraser Co., Inc., The..... 191

Fanner Mfg. Co. ..... 29
Fargo Mfg. Co., Inc..... 167
Federal Pacific Electric Co..3rd Cover
Foster Wheeler Corp.....30, 31
Four Wheel Drive Auto Co..... 42

General Electric Co.
Apparatus Dept...47, 48, 49, 50, 115
116, 117, 118, 121
Construction Materials Div..122, 123
Lamp Div. ..... 185
Gould-National Batteries, Inc.... 173
Guaranty Trust Co. of N. Y..... 179

Harper Co., H. M..... 43
Hazard Insulated Wire Works... 4
Hi-Voltage Equipment Co..... 72
Hubbell Inc., Harvey..... 161

I-T-E Circuit Breaker Co., Switchgear Div. .....156, 157
I-T-E Circuit Breaker Co., R&IE Equipment Div..... 33
Indiana Steel & Wire Co., Inc.... 160
Industrial Models Inc..... 190
Ingersoll-Rand .....18, 19

Johns-Manville ..... 172

KPF Electric Co. ..... 46
Kearney Corp., James R..... 66
Kellogg Co., The M. W..... 61
Kimble Glass Co., Sub Owens-Illinois ..... 76
Klein & Sons, Mathias ..... 165
Kuhlman Electric Co.....4th cover

Lapp Insulator Co., Inc..... 79
Line Material Co.....11, 12, 13, 14

Mallory & Co., Inc., P. R..... 28
McGraw-Hill Book Co, Inc..... 188
Mercoid Corp., The ..... 166
Moloney Electric Co. ..... 82
Morrison Steel Products Inc..... 154

National Electric Coil Co..... 78

Ohio Brass Co. ..... 153
Okonite Co., The..... 4
Onan & Sons Inc., D. W..... 170

Pacific Coast Engineering Co.... 64
Page Fence Ass'n ..... 187
Palnut Co., The ..... 188
Pennsylvania Transformer Co. 163, 164
Penn-Union Electric Corp....128, 129
Philco Corp., Industrial Div....20, 21
Porcelain Products, Inc..... 54
Preformed Line Products Co..... 62
Pyrene-C-O-Two ..... 199

Radio Corp. of America ..... 35
Reliable Electric Co..... 34
Revere Copper & Brass, Inc..... 125
Richardson-Allen Corp. ..... 168
Riley Stoker Corp.....16, 17
Roebling's Sons Corp., John A... 149

S&C Electric Co.....6, 7
Searchlight Section .....194, 195
Simplex Wire & Cable Co..... 10
Southern States Equipment Corp. 63
Standard Oil Co., (Indiana)..... 73
States Co., The..... 171
Stone & Webster Engineering Corp. .....174, 175
Stull's Chemicals ..... 190
Superior Switchboard & Devices Co. ..... 186

Tel-E-Lect Products, Inc..... 191
Thomas & Sons Co., R..... 60

United States Rubber Co.....22, 23

Victor Insulators Div., I-T-E Circuit Breaker Co..... 127

Wagner Electric Corp. .....70, 71
Westinghouse Electric Corp....44, 53
135, 136, 137, 138, 139, 140, 141, 142
Willys Motors, Inc.....186, 187


■


PROFESSIONAL SERVICES ..... 192


■

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.


EMPLOYMENT
Positions Vacant ..... 194
Selling Opportunities Offered..... 194
Positions Wanted ..... 195
Employment Services ..... 194

EDUCATIONAL
Periodicals ..... 195

NOTICES
Proposal .....194, 195

EQUIPMENT
(Used or Surplus New)
For Sale .....195

# SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

**UNDISPLAYED** —RATES— **DISPLAYED**

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

POSITION WANTED, undisplayed rate is one-half of above rate, payable in advance.

*Box Numbers*—Care of publication count as one line.

*Discount* of 10% if full payment is made in advance for 4 consecutive insertions.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Display Style.

*Individual Spaces* with border rules for prominent display of advertisements.

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

*An advertising inch* is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

**SEND NEW ADVERTISEMENTS TO: 330 W. 42 St., N. Y. 36, N. Y., for March 7th issue closing February 25th**

*REPLIES (Box No.): Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (36)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*
*LOS ANGELES: 1111 Wilshire Blvd. (17)*

## ELECTRICAL ENGINEERS

### Foreign Employment

Graduate engineers with minimum 5 years' experience in operation, design, maintenance or construction of power generation, transmission and dispatching; radio & VHF communications or heavy industrial facilities.

For specialized assignments commensurate with qualifications in a large scale foreign operation embodying oil producing, refining, together with all supporting facilities including all utilities.

Write giving full particulars regarding personal history and work experience. Please include telephone number.

*Recruiting Supervisor, Box 9*

**ARABIAN AMERICAN OIL COMPANY**
**505 Park Avenue**
**New York 22, New York**

## DESIGN ENGINEERS

For power and lighting systems on commercial, industrial and institutional building projects. Large architect — engineering firm located in Detroit. Write particulars to

P-5511, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

## WANTED

Unusual opportunity for salesman, experienced in calling on utilities to head up a well established North Atlantic states territory for eastern manufacturer of Pole line hardware specialties. Current earnings five figures. Expenses. Incumbent retiring because of exigencies beyond his control.

SW-5416, Electrical World
330 W. 42 St., New York 36, N. Y.

## Electrical Engineering

### DESIGNERS AND DRAFTSMEN

Experienced in Power Wiring and Industrial Lighting Layouts, Application of Electrical Controls and Equipment on Plant Apparatus, Drives, etc.

**Solvay Process Division**
*Engineering Division*
**Allied Chemical & Dye Corp.**
Syracuse 1, New York

## *Foreign Service*
## RELAY TECHNICIANS

Qualified Journeyman Electrician with minimum 2 years' experience as a Relay Technician investigating and correcting power line circuit troubles caused by relay failures.

*Write giving full particulars regarding personal history and work experience. Please include telephone number.*

Recruiting Supervisor, Box 101
**ARABIAN AMERICAN OIL COMPANY**
505 Park Avenue New York 22, N. Y.

**WANTED**
**DISTRIBUTION ENGINEER**

To head up this activity on a system basis with a rapidly growing medium-size midwest utility company. Must be a graduate engineer with considerable experience in distribution, planning and construction. Send resume of experience and qualifications to

P-5043, Electrical World
330 West 42nd Street, New York 36, New York

**MANUFACTURER REPRESENTATIVES WANTED**

To represent manufacturer for complete line of live line tools. Must have contacts with safety engineers, line superintendents and foreman with utilities. Advise regarding non-conflicting lines now handled and territory effectively covered. All replies strictly confidential.

**SAFETY LIVE LINE TOOL COMPANY**
**973 - 86th Avenue, Oakland 21, California**

## POSITIONS VACANT

DISTRIBUTION ENGINEERS — Competent graduate electrical engineers with at least 10 years experience design, operation and maintenance of distribution facilities required by rapidly growing utility desirable location South America. Portuguese or Spanish useful—not required to start. Reply stating age, education, experience, personal particulars and minimum salary expected. P-5569, Electrical World.

DISTRIBUTION ENGINEERS — Graduate Electrical Engineers — Senior — at least 10 years field experience with operating utility company. Junior 3 years experience. Permanent position long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-5572, Electrical World.

PUBLIC SERVICE Company of New Mexico has position for Graduate Electrical Engineer capable in distribution, substation and transmission work with minimum experience of five years and under forty years of age. Job will be fifty percent field work. Send full particulars and asking salary to Walter J. Dolde, P. O. Box 1360, Albuquerque, New Mexico.

ELECTRICAL ENGINEER—Graduate with at least 5 years experience protective relay work with electric operating utility company. Relay studies, system development studies and general technical electrical operating and design work. Permanent position long established consulting organization. Headquarters New York. Some travel Latin America. Knowledge of Spanish or Portuguese desirable—not essential. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-5575, Electrical World.

GRADUATE ELECTRICAL Engineers — one senior—two juniors—senior at least 10 years experience—junior 3 to 5 years experience in electrical design, operation and construction of steam, hydro plants and substations. Permanent position with long established consulting organization for public utility operating companies located Latin America. Headquarters New York. Some travel necessary in future. Knowledge of Spanish or Portuguese useful—not essential. Salary commensurate with qualifications. Good opportunity. Reply stating age, education, experience and personal particulars. P-5576, Electrical World.

LIAISON ENGINEER — Mechanical Engineer preferred. Desire experienced man with construction and/or operating steam plant background for use as liaison engineer between this organization and prime contractor on construction of new 100,000 KW Steam Plant. Salary Open. In reply, state education, employment and experience record, and references. Address: District Personnel Department, P. O. Box 1980, Phoenix, Arizona.

## EMPLOYMENT SERVICES

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo, N. Y.

## U. S. Government

Sealed bids will be received in the office of Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone, until 10:00 A.M., EST, March 11, 1955 for furnishing all labor, equipment, material and performing all work required for alteration of Gatun Hydro-electric Station and outdoor switchyard; conversion of station service, penstock headgate, spillway equipment from 25 to 60 cycle; construction of a new control room; purchase and installation of new transformers, metal clad switchgear and associated bus duct. Plans and specifications are available for examination in the office of Procurement Officer, Panama Canal Company, 21 West St., New York 6, N. Y., and copies may be obtained upon payment of $40.00 deposit. For further information call Bowling Green 9-5380.

## 8100 KVA
## Diesel Power Plant

***For sale Complete or as Individual Units. New 1943. Can be inspected operating.***

3—Busch-Sulzer Diesel Engines, 3060 HP, 9 cyls., 2 cycle, 240 RPM. Type 9 DHB-27½, direct coupled to:

3—2700 KVA Electric Machinery Alternators, .8 PF, 2160 KW, 3/60/2300/4160 volts, with 30 KW, 125 volt, V-belted Exciters. Complete with all auxiliaries.

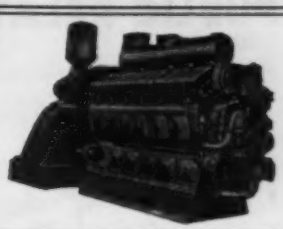
**HEAT & POWER CO., INC.**

70 Pine St. New York 5, N. Y.

*HANOVER 2-4890*



## DIESEL POWER



**IMMEDIATE SHIPMENT**

• PURCHASE OR RENTAL

UNIT CAPACITIES—10 TO 2475 KVA

A.C.—50 AND 60 CYCLES

• ALSO D.C. UNITS

*A PARTIAL LISTING OF OUR INVENTORY*

| KW | Make | Model | HP | RPM | KW | Make | Model | HP | RPM |
|---|---|---|---|---|---|---|---|---|---|
| 1180 | Worthington | SEH-8 | 1685 | 360 | 320 | Superior | 60E-6 | 460 | 450 |
| 1136 | Fairbanks Morse | 38D | 1600 | 720 | 300 | Fairbanks Morse | 32E14 | 450 | 300 |
| 1100 | General Motors | 16-278A | 1600 | 720 | 300 | General Motors | 8-268A | 450 | 1200 |
| 1000 | General Motors | 16-567B | 1440 | 720 | 250 | Clark | GD-4 | 375 | 360 |
| 750 | General Motors | 12-567 | 1080 | 720 | 200 | General Motors | 6-268A | 330 | 900 |
| 700 | Worthington | EE-8 | 1000 | 327 | 175 | General Motors | 12-71 | 275 | 1800 |
| 675 | Fairbanks Morse | 38D | 960 | 720 | 150 | Buckeye | 80 | 240 | 600 |
| 500 | General Motors | 8-567 | 720 | 720 | 148 | Fairbanks Morse | 32E14 | 220 | 300 |
| 500 | Alco | 6-121x13T | 750 | 600 | 100 | General Motors | 3-268A | 150 | 1200 |
| 350 | Baldwin | VO-6 | 510 | 450 | 60 | General Motors | 6-71 | 90 | 1200 |
| 320 | Enterprise | D8G-6 | 460 | 450 | | | | | |

**A. G. SCHOONMAKER COMPANY, INC.**

DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.


### POSITION WANTED

GRAD. ENG., 20 yrs. exp., Elect. Const., utility operation and const., and plant elect. maint. Want challenging work. Will relocate. PW-5395, Electrical World, 520 N. Michigan Avenue, Chicago 11, Illinois.

### PERIODICALS

**A.I.E.E. transactions back-volumes wanted** to buy for cash. Ashley 24 E. 21, N.Y.C. (10).

### OFFICIAL PROPOSALS

Bids: March 22, 1955

***Power Authority of the State of New York***

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF 86,000 KVA SINGLE PHASE POWER TRANSFORMERS

SPECIFICATIONS NO. PA-4-14002
ST. LAWRENCE CONTRACT NO. P7

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture and furnishing of 86,000 kva, single phase power transformers and delivery thereof f.o.b. Massena, New York, until 10:30 a.m. Eastern Standard Time, March 22, 1955, at the Authority's office, 270 Broadway, Room 1207A New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

Bids will be entertained for 13, 7, 6 or 1 power transformers and associated equipment and services in accordance with the bidding schedules. Erection at the site of installation will be done by others but services of erection engineers shall be provided by manufacturers if and when required.

Bids will not be restricted to American manufacturers.

Plans, specifications and proposal forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications, and proposal forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1207A New York 7, New York, upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contract documents and Five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Guarantee will be required with each bid in an amount not less than 10 per cent of the maximum price bid for any schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

PA-4-14002


### DIESEL ENGINES AND GENERATORS

2—290 KW General Motors 8-268-A, 1200 RPM, (Ser. #6253 & 6256), with Westinghouse Generator (Ser. #118-12P-807 & 186-12P-807), 120-240 Volts DC. Units rebuilt by GM; complete with engine accessories.

2—450 HP General Motors 8-268-A Engines, (Ser. #6045 & 6064), 1200 RPM. Units rebuilt by GM; complete with engine accessories.

6—200 KW General Electric, type ATI, Generators, 1200 RPM, (for connection to above engines), 3/60/450 volts, 320 amps, with exciter 40 KW, GE, 120 volts DC, (typ. ser. #5603547), excellent used condition.

**EASTERN SCRAP AND SALVAGE**
—CORPORATION—

65 Muirhead Ave. OWen 5-6349 Trenton, N. J.



## TRANSFORMERS
### FOR SALE

3—1000 KVA Moloney 13200-2300/4000Y
3— 833 KVA G-E 35000—480
3— 500 KVA G-E 25400—240/480
5— 333 KVA W-H 38000-7200/12470Y
3— 223 KVA G-E 33000-2300/4000Y/8900/-11950Y
3— 333 KVA G-E 33000-2300/4000Y
3— 333 KVA Mol 7200/12470Y-2300/4160Y
3— 150 KVA G-E 19050/33000Y-2540/4000Y
5— 150 KVA G-E 7200/12470Y-240/480
3— 100 KVA G-E 33000-8900/11950Y

Many other items in stock.

**TRANSFORMERS WANTED**

Reliable rewind and repair service on all makes of transformers

**THE ELECTRIC SERVICE CO.**
**Cincinnati 27, Ohio**
*40 Years Dependable Service*



## ELECTRICAL WIRE AND CABLE

—Your Best Source—
- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in Midwest
Let us quote on requirements—
send your inquiries
We'll also buy Surplus
Branch Offices:
Houston—Yukon 5847 Los Angeles—ANgelus 2-8148

**UNIVERSAL** Wire and Cable Co.
3662 N. Elston Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE



### 1250 HP ELECTRIC MOTORS

5—1250 HP Allis Chalmers, 1180 RPM, type ANW, 3/60/2300 volts, (typical serial #154341), excellent used condition.

**EASTERN SCRAP AND SALVAGE**
—CORPORATION—

65 Muirhead Ave. Trenton, N. J.
OWen 5-6349



Specialist for 47 Years in—

### LARGE POWER EQUIPMENT

Do you receive our stock list? Prompt shipment from inventory. A.C. & D.C. Motors, Transformers, M-G Sets, Frequency Changers, Controls, Turbo-Generators and Circuit Breakers. Attractive prices for rebuilt-guaranteed equipment. Contact us before purchasing.

**BELYEA COMPANY, INC.**
51 Howell St. Jersey City 6, N. J.



New and Used Equipment Available for
**POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION**
Send for new list to
**EBASCO SERVICES INCORPORATED**
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

## Chicago Birdwatchers in Dither

Ornithologists (bird experts to you) excitedly reported advent of two hitherto unknown birds in the Chicago area last month. Pictured above they are dubbed "Little Bill" distinguished by his call, "Cheap, cheap, cheap," and "Big Bill" who doesn't say anything but has a gnawing appetite for dollar bills. "Little Bill" who works for pennies a day is the new symbol for low cost electricity. "Big Bill," who eats money represents the high cost of living. The specimens pictured above made their first appearance Jan. 31 in a series of newspaper advertisements sponsored by Commonwealth Edison and Public Service Co. The utilities are out to make "Little Bill" the best known commercial symbol in their service area.

## Companies Aid Farm, Communities Projects

Pennsylvania Power & Light Co is joining with the Pennsylvania State Chamber of Commerce in an effort to spur community development in the state. Supplementing the $10,000 Chamber-sponsored community development contest, PP&L will match any prizes won by communities in its service area or that of its Scranton Electric subsidiary.

Kentucky Utilities Co has leased to the University of Kentucky, rent-free for 21 years, a 400-acre farm near Dix Dam on Herrington Lake, to be used for agricultural research.

Both utility programs are aimed at improving community relations. Pres R. M. Watt of the Kentucky utility said, "We want to help the university in the important job of improving the living standards of the rural people of Kentucky. This is in keeping with our vital interest in the total economy of Kentucky and our active cooperation in programs of agricultural, community, and industrial development."

In offering to match community development prizes in its service area, the Pennsylvania company is continuing its activity in community betterment work. Pres Charles E. Oakes of PP&L told area newspapers, "We in the company are confident that a good share of the state-wide prize money will find its way to this area. Active community competition in this worthwhile contest can produce community benefits which will far outshine the worth of the actual prize money."

## Explains Atomic Energy

Second in its series of pamphlets explaining the use of nuclear energy to produce electricity has been released by Consolidated Edison Co of New York. First discussed energy sources. This one is more advanced. It is a simple lesson in nuclear physics profusely illustrated and aimed at the layman. Con Ed is preparing its customers for the day when it will build its first power plant using a nuclear fuel. This plant, which is to be built at Indian Point on the Hudson, is now in the planning stage. For details see news pages in front of book.

## TVA Press Handbook For Quick Reference

Handy loose-leaf booklet containing background information on Tennessee Valley Authority system and operations has been issued to reporters covering the agency.

A product of the TVA information office, the quick-reference, 100-page handbook contains factual information on all TVA power plants, a system map, an organization chart, and names of top officials. There is also a chronology of the agency and brief explanations of its various operations.

In a foreword, the TV information office says the handbook data are intended to help writers and editors supplement wire service and other news stories. The office also invites press inquiries anytime day or night.

## Digest Takes ECAP Ad

Electric Companies Advertising Program is placing a two-color ad in Readers Digest for April—the first domestic issue of that magazine ever to carry paid advertising. Readers Digest circulation is in excess of 10 million. Title of the ad will be "How Much Would You Contribute for a Socialistic USA?" It will be ECAP's first use of a second color in a national magazine.

## Fitzgerald Firm Moves

Stephen Fitzgerald & Co. which handles the public relations account of the National Association of Electric Companies, has moved its offices to 575 Madison Ave, New York 22, N. Y. Phone number remains the same. The firm was formerly located at 502 Park Ave.

## Makes Refrigerators Safe

Utility campaigns to put an end to "death trap" refrigerators have borne fruit. A resident of Louisville, Ky., has invented a gadget to unlock doors from the inside.

## READERS FORUM

# The Fuse Isn't Always the Weakest Link

Now don't get me wrong, Sam. I'm not looking for an argument, nor am I questioning your ability. But how safe is your best job? Let's look at that one over on Kentner St. Yeah, the one that had the fire. Now don't get sore. I'm merely trying to make you see what I'm driving at. You see a wiring job goes just a bit further than the wires you install. If you'll bear with me long enough to analyze that job, perhaps we might just stumble upon something that may do the entire electric business some good.

Let's start where you installed the weatherhead on the entrance. Perfect. And right on down through the conduit to the meter, switch, distribution circuits. Let's check at this point. One-hundred-amp mains, range circuit, water heater and dryer circuits, and six 2-wire circuits. Nice box. A little crowded perhaps but still adequate. Also it carries the Underwriters Lab's seal of approval. Must be OK.

Now that's a good circuit to the range—No. 6 3-wire, and three No. 8's to the dryer. You used No. 10 wire to the wall plugs in the kitchen; No. 12 to the outlets in the living room on a circuit by themselves. In fact No. 12 is the smallest size wire you used, and you divided things up very nicely on all six circuits. But a few spare circuits would have provided for the future.

Now just be patient. The papers did say the fire was caused by defective wiring. The fire boys said the cord to one of the floor lamps shorted and set fire to the davenport. Why should it have done that, Sam?

You fused that circuit with a 20-amp fuse as recommended for that size wire. Now let's pause here and do a little thinking. No. 12 wire according to the code should carry 20 amp safely, so a 20-amp fuse. Fine. Or is it? Let's follow this circuit to the end. Now where did you get that wall plug? I see it was stamped 10 amp and had a UL stamp on it. I suppose it was OK although a little light.

Ten amp at 120 v allows 1,200 w. I don't suppose there ever would be that much load on a floor lamp. Anyway the cord on that lamp had a stamp on it that rated it at 600 w, and anyone could see it could not handle much more than that. But that 20-amp fuse down in the basement was on guard; so why worry?

Sam, that 20-amp fuse seems rather large for such a little job, something like hitching a bulldozer to a kiddie car. Why Sam, I really think this item caused the trouble.

Supposing you had put in a 5-amp fuse. Five times 120 is 600 w. Just what was stamped on that cord. Using that same figuring, 20 times 120 is 2,400. Wow! That's 400% loaded. I'll bet that little cord would heat up with that much load to handle. Sure I can see why you didn't use a 5-amp fuse. If another appliance had been plugged into the other side of the outlet, the fuse wouldn't last a minute.

Now if there were some way to protect a lamp or appliance right in its own attachment plug, a 5-amp fuse for a lamp, a 1-amp for a clock, get the idea, Sam. That would really cinch the stamp the UL puts on cords and appliances. Then I'll bet you wouldn't be getting all riled up when someone says a fire was started by defective wiring when it was really caused by a hot cord or faulty appliance.

After all, Sam, you must admit that as far as your customer is concerned, his wiring includes the uses he puts it to. That's what he had you wire his home for. Now a little effort on the part of appliance manufacturers would keep your wiring job as safe as you installed it. And everybody would be safer.

Harold G. Cooper
Professional Engineer

1115 Grove St
Defiance, Ohio

● Mr Cooper's contribution was submitted as a letter, but because of the way in which it is written, the line, "To the Editor", was purposely omitted.

## Calls Open Primaries Obsolete

To the Editor:

In your editorial of the Jan. 3 issue you comment:

"Obsolescence casts its shadow also on hundreds of thousands of small distribution transformers and many miles of No. 4 or smaller secondaries. And its shadow doubtlessly falls to a lesser degree on primaries, substations, and even sub-transmission."

It seems to me that the experiences with Hurricanes Carol and Edna taken together with the daily additions of "many homes—wired for 14-kva demand" make the open-wire primary lines the most obsolete element of existing distribution systems. Why should there be any secondary distribution when more than one of the 14-kva houses comes on the line? Why not install a separate 7½ or 10-kva transformer on the nearest pole, or better yet why not mummify the transformer so that it may be buried in the ground as close to the service and meter as possible. Separate-transformers were the usual installation for farmers in the early REA days.

An electric home today requires 100% reliability of service. Aerial cable or buried cable—not in conduit—are both sound solutions.

Primary circuits must be storm-proofed whenever all-electric homes are served. The existing secondary distribution wires can be cut back step by step when new connections are made through individual transformers. The reliability of the primaries is the most important factor for the distribution engineer.

New all-electric homes are in the load class of small commercial customers and sooner or later must be supplied under comparable rate schedules.

Carroll H. Shaw
Consulting Engineer

132 Nassau Street
New York 38, N. Y.

## WASHINGTON COMMENT

# What's What on the Dixon-Yates Contract

**Despite all the attacks on it, the contract is valid and in effect. Shortly construction will start on the 600,000-kw power plant which will supply AEC**

A common question in Washington these days is, "What's going to happen to the Dixon-Yates contract?" Many of the questioners are ill informed on the background of this controversial document. But there are others who have followed its progress carefully and still cannot weigh its chances.

Let us weigh them in light of the information available.

- The contract is valid.
- It is in effect.
- Its financial aspects have the approval of the Securities and Exchange Commission.
- It has been assessed and evaluated by all interested federal agencies and the president. None has found fault with it. Those most vitally interested have seen it as fair and reasonable to the government—which is the only issue in question.
- Most important, perhaps—and a point constantly overlooked—it has the approval of the Atomic Energy Commission, the agency which will pay for the power under the contract.
- Lastly the Joint Committee on Atomic Energy, whose Democratic members have harassed the negotiations since last spring, has voted to put aside the matter for at least a month while it tends to other matters.

That's a formidable list of factors in favor of the contract and of its chances of success. There are others too. One is the fact that government-ordered cancellation will require federal reimbursement for the money already spent for engineering surveys and planning.

What will happen next? Has the delay caused by the constant Democratic sniping pushed back construction plans? Has the haggling caused prospective investors to back down? In short, despite the widely accepted legality of the contract, is it in trouble?

The answer is "No."

Dixon-Yates officials have operated on the assumption that their contract was in effect since the General Accounting Office issued its opinion in mid-December. They had warned that failure of the Joint Committee on Atomic Energy to give its approval before the end of 1954 would cause them to hold up groundbreaking until spring floods on the Mississippi had subsided. This would mean a year's delay in getting power. But they got that approval and are ready to begin construction shortly.

All this means that: The AEC will have its power when it needs it, the people of the Mississippi Valley will have added back-up of 600,000 kw, TVA will have another private power ally pumping power into its grid, and it also means that one more taxpayer has been placed on the federal tax rolls.

## TECHNICAL NOTES

**Loudness level of transformer noise** does not decrease in conformity with the law of spherical divergence and therefore has to be determined separately for each distance.

**Powerhouse cranes** designed for maintenance lifts instead of heavy installation duty can save investment cost. Entire units are handled but once and can be placed cheaper by other methods.

**Proposed new wiring code** for trailer camps sets 2,400-w demand per parking space. Demand factor is 100% on 1st 10, 80% on next 10, and 50% on all spaces over 20.

**Fire** must be extinguished in seconds. Most hand extinguishers exhaust themselves in less than 60.

**Capacitor failure** damage is closely related to protective fuse size.

**Reactive** load measurements are essential to intelligent capacitor application.

**Internal corrosion** of fuel oil tanks is reported inhibited by addition of alkaline sodium nitrite to 0.25% concentration.

**Owned in fee,** 100-ft transmission rights-of-way provide unrestricted choice of sites for future distribution substations.

**Fewer ground faults** experienced on neutral-grounded industrial systems save expense in locating and repairing faults.

**Resonant neutral grounding** not only extinguishes transient faults to ground but can permit continued operation pending correction of a persistent fault.

**Adequate wiring** for some people means including circuits for music in every room from a built-in "music bar."

**Rasap** is proposed as an abbreviation for rectifier-and-sacrificial-anode protection of metallic underground plant against galvanic corrosion.

## ALL TYPES...ANY CLASS FIRE!

Since different fire hazards require different types of fire extinguishers, PYRENE—C-O-TWO manufactures all types . . . the finest and most complete line on the market today.

When doing business with PYRENE—C-O-TWO, you receive unbiased advice on what is best for your particular fire hazards, whether class A, B or C. Also, there is a well-rounded sales engineering organization having nation-wide representation to render top quality service wherever you're located.

Don't take unnecessary chances . . . the extensive fire protection experience of PYRENE—C-O-TWO over the years is at your disposal without obligation. Get complete facts now!

Pyrene

**PYRENE — C-O-TWO**

**NEWARK 1 • NEW JERSEY**

Sales and Service in the Principal Cities of United States and Canada

C-O-TWO

**COMPLETE FIRE PROTECTION**

portable fire extinguishers . . . built-in fire detecting and fire extinguishing systems

CARBON DIOXIDE • DRY CHEMICAL • VAPORIZING LIQUID • SODA-ACID • WATER • CHEMICAL FOAM • AIR FOAM

# California Speeds Up Hearings

**PUC pre-hearing meeting is held where commission staff, utility, and interested parties outline evidence to be presented**

The California Public Utilities Commission is pleased with results of an experiment conducted during the past year with the aim of speeding up hearings.

The commission made frequent use of the "pre-hearing conference," a session at which the commission staff, the utility, and interested parties outline the evidence they will present to the regulatory body.

That commissioners are beginning to regard these conferences as a necessary component of many types of hearings is indicated by a letter sent out recently by Commissioner Justus F. Craemer to parties interested in the hearing on San Diego Gas & Electric Co's rate hike application. Craemer incorporated the planning session in the formal hearing, devoting first day of the hearing to discussion of evidence to be presented to the commission.

## Conference Objectives

Main objective of these conferences is to allow participants to clarify the issues involved in the application, throw out those that are extraneous, and occasionally add some that are relevant. (For instance, a recent application for a rate increase did not mention that the utility planned a substantial cut in service. This fact was brought out in the pre-hearing conference and the service cut was considered along with the rate issue.)

Another important function of the conference is to permit parties to exchange exhibits, which expedites cross examination.

Representatives of civic groups and other interested parties usually are invited to the conference. Letters are sent to representatives of special interest groups who have attended previous hearings on similar issues. In most cases the press is invited to attend this meeting.

This technique, which the California PUC calls the "community forum" approach, has proved very useful. Civic representatives often come up with good ideas, some of which have been incorporated in commission orders. Also, the face-to-face discussion is a good way for utilities and the people they serve to work out disagreements. If the applicant can satisfy opponents on a side issue involved in the application it may not be brought up in the hearing, and considerable time is saved.

No set procedure is followed by the California commission. The commissioner assigned to the case decides whether to schedule an informal conference and it's up to him to notify all interested parties in the proceeding.

## Calepco Withdraws Bid To Buy Municipality

California Electric Power Co has withdrawn its offer to purchase the Riverside, Calif., Municipal Department of Light, pending a study aimed at presentation of a plan "more advantageous to the city and its taxpayers."

Calepco had offered on Nov. 24 to purchase the municipal utility for approximately $6 million, the exact amount to be determined through negotiations.

According to Calepco Pres Albert Cage, the offer has been temporarily withdrawn because the present economic and engineering studies cannot be completed prior to municipal elections in April.

Cage said that the company is considering a Riverside location for extensive facilities in addition to the general office building mentioned at the time of the original proposal. He said total expenditures for power production and other facilities now under consideration total an estimated $18 million.

Calepco is headquartered in Riverside, but before the purchase offer had announced plans for building new general offices in San Bernardino, part of the company's service territory.

## Seattle Schools Get New Electric Rates

A rate adjustment for electricity furnished public schools at Seattle, Wash., has been announced by Seattle City Light.

Seattle School District No. 1 will save $55,000 annually under the rate adjustment, while suburban school districts will save smaller amounts, varying from 25-33% of their present bills. Parochial schools, which have been paying the lower church rate, will pay slightly more under the new schedule, increases for the 47 parochial schools affected totaling approximately $3,000 a year.

"The average cost to most schools will be under 1¢ per kwhr, as compared with an average of close to 2¢ paid by schools in other area," said Paul J. Raver, City Light Superintendent.

The reduction will be the second in four years for some of the schools, Raver said. Schools benefitted by a total saving of $8,000 annually when City Light took over Puget Sound Power & Light Co properties in the Seattle metropolitan area in 1951, said Raver.

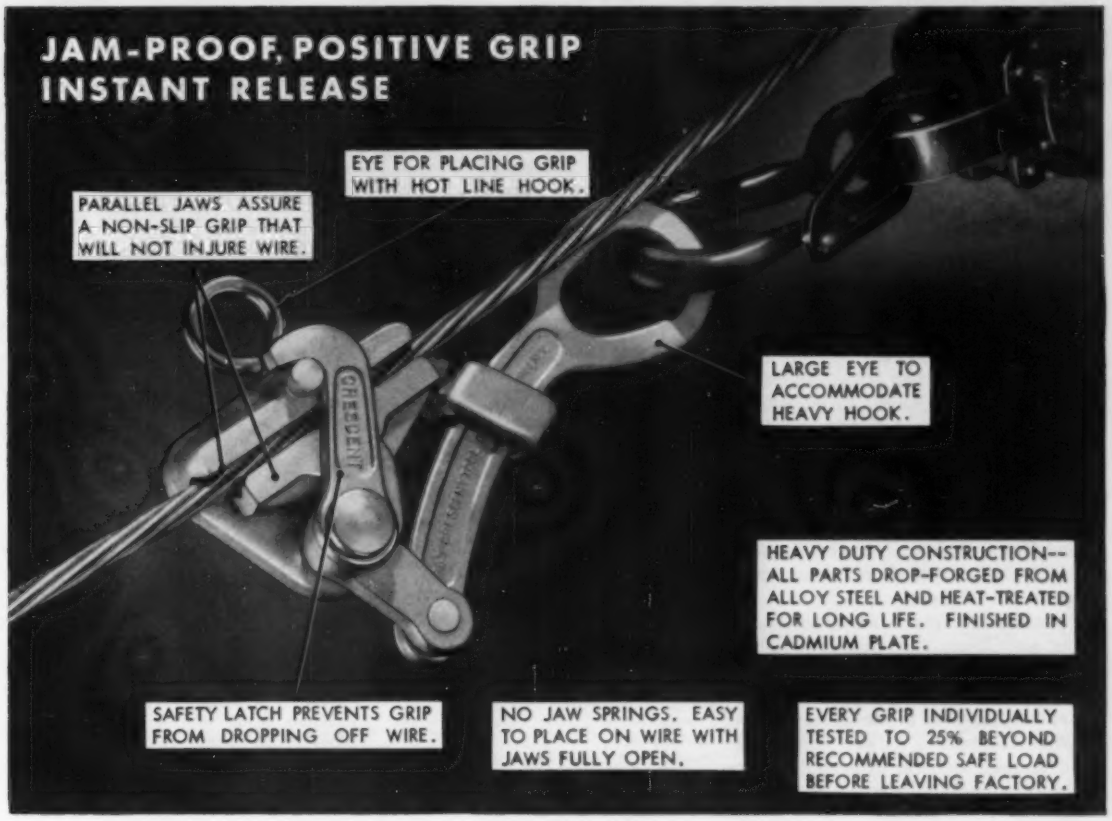
## Washington State Plans A Package Tax Bill

Contractors and electric companies are affected by a package tax bill now before the Washington state legislature.

One provision calls for extension of the present 3% sales tax to utility bills to raise an estimated $8 million while another calls for amending the present law to apply to the sales tax to contractors of federal projects, to raise about $10 million.

An earlier proposal to double the tax on public utilities was abandoned when the chairman of the House

# CRESCENT WIRE GRIPS


JAM-PROOF, POSITIVE GRIP
INSTANT RELEASE
EYE FOR PLACING GRIP WITH HOT LINE HOOK.
PARALLEL JAWS ASSURE A NON-SLIP GRIP THAT WILL NOT INJURE WIRE.
LARGE EYE TO ACCOMMODATE HEAVY HOOK.
HEAVY DUTY CONSTRUCTION--ALL PARTS DROP-FORGED FROM ALLOY STEEL AND HEAT-TREATED FOR LONG LIFE. FINISHED IN CADMIUM PLATE.
SAFETY LATCH PREVENTS GRIP FROM DROPPING OFF WIRE.
NO JAW SPRINGS. EASY TO PLACE ON WIRE WITH JAWS FULLY OPEN.
EVERY GRIP INDIVIDUALLY TESTED TO 25% BEYOND RECOMMENDED SAFE LOAD BEFORE LEAVING FACTORY.

## SPECIFICATIONS

| *Number* | *Maximum Capacity* | *Minimum Capacity* | *Safe Load* | *Eye Opening* | *Weight* |
|---|---|---|---|---|---|
| 383 — Serrated Jaws | 5/16 ( .3125)" 8 mm. | — 5/32 (.156 )" 4 mm. | 5,000 lbs. (2200 KG) | 1-1/8" x 1-11/16" | 1-3/4 lbs. |
| 383-2 — Same, except with smooth jaws for aluminum wire. | | | | | |
| 384 — Serrated Jaws | 1/2 ( .500 )" 12.2 mm. | — 1/4 (.250 )" 6.5 mm. | 7,500 lbs. (3400 KG) | 1-1/4" x 1-3/4" | 3-5/16 lbs. |
| 384-2 — Same, except with smooth jaws for aluminum wire. | | | | | |
| 385 — Serrated Jaws | 3/4 ( .750 )" 19 mm. | — 3/8 (.375 )" 9.5 mm. | 10,000 lbs. (4500 KG) | 1-1/4" x 1-3/4" | 4-7/8 lbs. |
| 385-2 — Same, except with smooth jaws for aluminum wire. | | | | | |
| 386 — Serrated Jaws | 1-1/16 (1.0625)" 27 mm. | — 9/16 (.5625)" 14.5 mm. | 12,500 lbs. (5600 KG) | 1-5/8" x 2-3/8" | 9 lbs. |
| 386-2 — Same, except with smooth jaws for aluminum wire. | | | | | |

For bare and insulated wire, use serrated jaw style. For bare aluminum wire only, smooth jaws.

*Write for Crescent Catalog No. 28 which illustrates and describes many valuable tools for linemen and other electrical workers.*

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

**CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK**

Committee on Revenue and Taxation said it would be "as bad as a poll tax or a tax upon bread."

W. G. Hallauer, Oroville Democrat, said testimony presented by representatives of private industry, public utilities, and the PUD's had convinced him that "imposition of an additional public utilities tax would be a great disservice to our state."

## FPC Announces Shifts In Organization

The Federal Power Commission has abolished its Bureau of Accounts, Finance and Rates, and Bureau of Law, replacing them with a new Bureau of Rates and Gas Certificates, Office of the Chief Accountant, and Office of General Counsel.

Abolished were divisions of Electric Power, Natural Gas, Interpretation and Research, and Hydroelectric and Licensed Projects, all of which were in the Law Bureau.

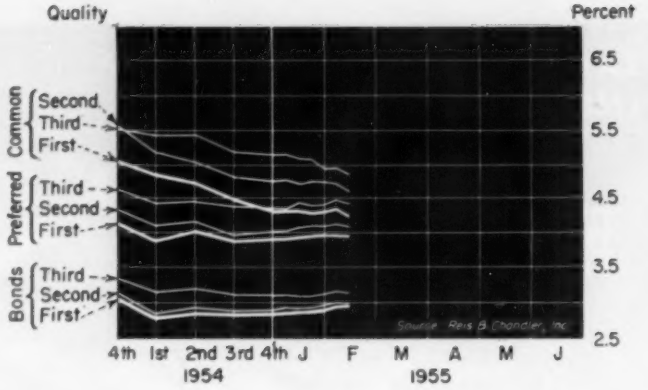
Carl T. Kallina is acting chief of the new Rates and Gas Certificates Bureau; Olof W. Nelson heads the Gas Certificates Division; Charles W. Smith is top man in the Office of the Chief Accountant; William W. Gatchell remains General Counsel, and J. Kay Lindsay is Director of Administration.

## FINANCIAL BRIEFS

**Sabina, Ohio,** citizens will vote Nov. 8 on whether the town should continue operation of its municipal power plant or sell it to Dayton Power & Light Co for $250,000 . . . South Vienna, Ohio, Board of Public Affairs voted to sell its municipal plant to Ohio Edison Co . . . Escanaba, Mich., citizens will vote on April 4 on whether or not to sell its municipal distribution system to the upper Peninsula Power Co for $12 million.

**Substantial savings** (some estimates range as high as $200,000 per year) are expected by Cleveland Electric Illuminating Co to result when every other month reading of meters of general commercial and residential customers is installed on April 1.

## Today's Utility Yields (%)




| | BONDS | | | PREFERRED STOCKS | | | COMMON STOCKS | | |
|---|---|---|---|---|---|---|---|---|---|
| QUALITY | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 1st | 2nd | 3rd |
| Feb. 10 | 2.95 | 2.99 | 3.13 | 3.97 | 4.09 | 4.41 | 4.22 | 4.60 | 4.89 |
| Feb. 3 | 2.96 | 3.00 | 3.13 | 3.96 | 4.08 | 4.41 | 4.31 | 4.68 | 4.90 |

## Utility Earnings

| COMPANY | PERIOD MONTHS ENDED | | NET INCOME 1954 | NET INCOME 1953 | EARNINGS PER COMMON SHARE 1954 | EARNINGS PER COMMON SHARE 1953 |
|---|---|---|---|---|---|---|
| Boston Edison | 12 | Dec. | $8,459,544 | $8,024,448 | $3.12 | $2.96 |
| California Electric Power | 12 | Dec. | 2,469,270 | 2,751,211 | 0.73(a) | 0.88(a) |
| Central Illinois Public Service | 12 | Dec. | 7,378,733 | 5,860,840 | 1.92(b) | 1.55(b) |
| El Paso Electric | 12 | Dec. | 2,158,256 | 1,680,680 | 2.43(c) | 2.11(c) |
| Idaho Power | 12 | Dec. | 4,818,907 | 4,502,831 | 3.60 | 3.35 |
| Middle South Utilities, consolidated | 12 | Dec. | 16,193,738 | 14,682,523 | 2.13(f) | 2.06(f) |
| Pacific Gas & Electric | 12 | Dec. | 63,039,000 | 59,693,000 | 2.89(b) | 3.12(b) |

Notes—All the figures in the above companies are subject to year-end audit; (a) Based on 2,668,934 shares in 1954 and 2,490,934 shares in 1953; (b) Based on average number of shares; (c) Based on 840,387 shares in 1954 and 763,988 shares in 1953; (f) Based on 7,600,000 shares in 1954 and 7,125,000 shares in 1953.

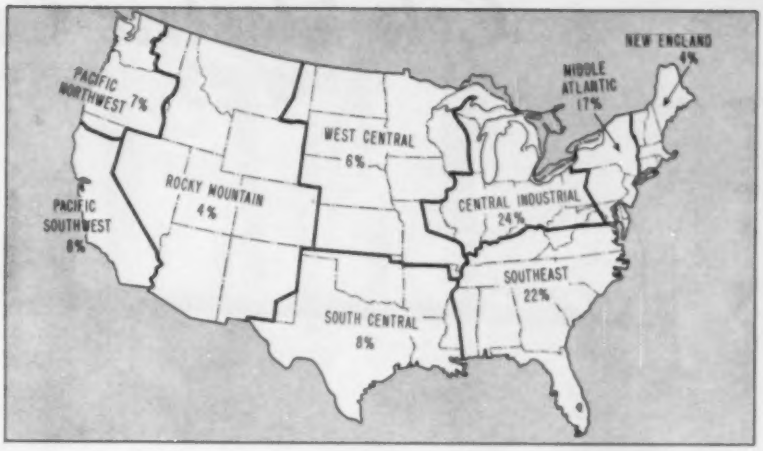
## Utility Financing

| COMPANY AND DESCRIPTION | AMOUNT OF OFFERING (000) | OFFERING PRICE | YIELD TO PUBLIC |
|---|---|---|---|
| WEEK OF FEBRUARY 10-16 | | | |
| BONDS AND DEBENTURES | | | |
| Dallas Power & Light—debs 3¼% due 1980 | $7,000 | 102.15 | 3.125% |
| Kansas City Power & Light—1st mtg 3¼% due 1985 | 16,000 | 102.52 | 3.12 |
| SCHEDULE FOR FEBRUARY | | | |
| BONDS AND DEBENTURES | | | BID DATE |
| Central Electric & Gas—conv. subord. debs due 1970 | $1,500 | | Feb. 17(a) |
| Texas Electric Service—1st mtg due 1985 | 17,000 | | Feb. 23 |
| Rochester Gas & Electric—1st mtg due 1985 | 10,000 | | Feb. 24 |
| PREFERRED STOCK | | | |
| Carolina Power & Light—50,000 sh serial cum no par | $ | | Feb. 23(b) |
| COMMON STOCK | | | |
| Carolina Power & Light—505,000 sh | | | Feb. 23(b) |
| South Carolina Electric Gas—210,053 sh (to be offered commonholders on a 1-for-15 basis, record Feb. 24 to expire March 10 with oversubscription privileges. Owners of less than 15 shares can subscribe to one full share) | | | |

Note—(a)Paine, Webber-Stone & Webster group, underwriters; and (b) Merrill Lynch, Pierce, Fenner & Beane—R.S. Dickson & Co., group, underwriters.

# STATISTICS

**Weekly output figures** setting new highs lately, (past 10 billion kwhr for weeks ending Jan. 29 and Feb. 5) are collected on a regional basis. Map shows this geographic alignment with percentage figures showing average distribution of output for 1954. Note heavy weighting in southeast and central industrial regions—figures traditionally high being upped even more with concentration of AEC projects in the areas.




Source: Edison Electric Institute

## Power Statistics . . .

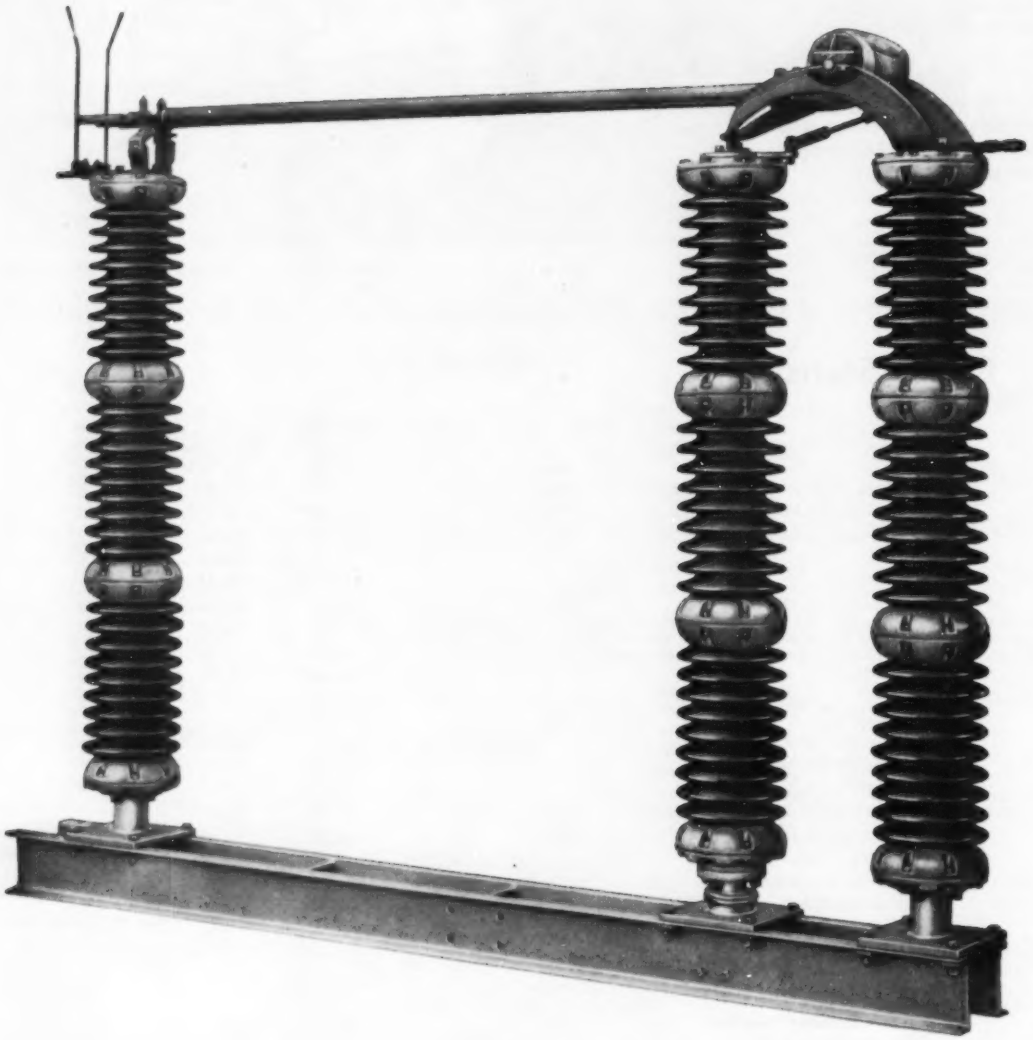
| | | | Latest Month | Preceding Month | Year Ago | Annual Change % |
|---|---|---|---|---|---|---|
| Capacity | million kw | Dec. | 102.52 | 110.12 | 91.49 | 12.1 |
| Peak—Class I Systems | million kw | Nov. | 81.9 | 79.9 | 75.3 | 8.8 |
| Estimated Dec. '55 Peak | million kw | Nov. | 96.1 | 96.2 | 98.3 | − 2.2 |
| Production—billion kwhr | | Dec. | 43.43 | 40.22 | 39.08 | 11.1 |
| hydro | | | 9.05 | 8.12 | 8.67 | 4.3 |
| fuel | | | 34.38 | 32.10 | 30.41 | 13.1 |
| Sales—billion kwhr | | Nov. | 33.87 | 33.75 | 31.59 | 7.2 |
| residential | | | 10.07 | 9.70 | 9.02 | 11.5 |
| commercial | | | 6.14 | 6.40 | 5.50 | 8.8 |
| industrial | | | 15.38 | 15.24 | 14.95 | 4.5 |
| other | | | 2.29 | 2.41 | 2.12 | 7.5 |
| Fuel Consumption | | Dec. | | | | |
| coal—million tons | | | 11.90 | 10.70 | 10.88 | 9.4 |
| oil—million barrels | | | 7.67 | 5.82 | 7.62 | 0.6 |
| gas—billion cu ft | | | 74.93 | 88.66 | 70.94 | 5.6 |
| Net Income Class A & B Co's—$ million | | Nov. | 94.91 | 86.98 | 83.86 | 13.2 |
| Residential Customers—millions | | Nov. | 43.04 | 42.95 | 41.89 | 2.8 |
| revenue per kwhr | | | 2.70¢ | 2.70¢ | 2.74¢ | − 1.5 |
| avg. kwhr per customer | | | 2,528 | 2,512 | 2,332 | 8.4 |
| avg. annual bill | | | $68.26 | $67.82 | $63.90 | 6.8 |

## Business Statistics . . .

| | | | | | |
|---|---|---|---|---|---|
| Indexes: 1947—49 = 100 | | | | | |
| FRB Industrial Production | Dec. | 128 | 130 | 124 | 3.2 |
| ENR Construction Cost | Jan. | 135.1 | 134.9 | 128.7 | 5.0 |
| BLS Cost-of-living | Dec. | 114.3 | 114.6 | 114.9 | − 0.5 |
| NEMA Sales | Dec. | | | | |
| insulation materials | | 138 | 124 | 133 | 3.8 |
| electric appliances | | 84 | 90 | 69 | 21.7 |
| household refrigerators | | 62 | 47 | 53 | 17.0 |
| Wholesale prices | Dec. | | | | |
| motors and generators | | 121.7 | 121.7 | 124.3 | − 2.1 |
| transformers and regulators | | 128.1 | 128.1 | 128.1 | ..... |
| switchgear and fuses | | 135.3 | 135.3 | 135.1 | 0.1 |
| GNP—annual rate—$ billion | 3rd qtr. | 355.5 | 356.0 | 367.2 | − 3.2 |

# Cole Electric Co.

8439 Steller Drive | TExas 0-4701 | Culver City, Calif.



**AIR BREAK DISCONNECTING SWITCH**

**161,000 Volts — 600 Amperes — Type O-2**

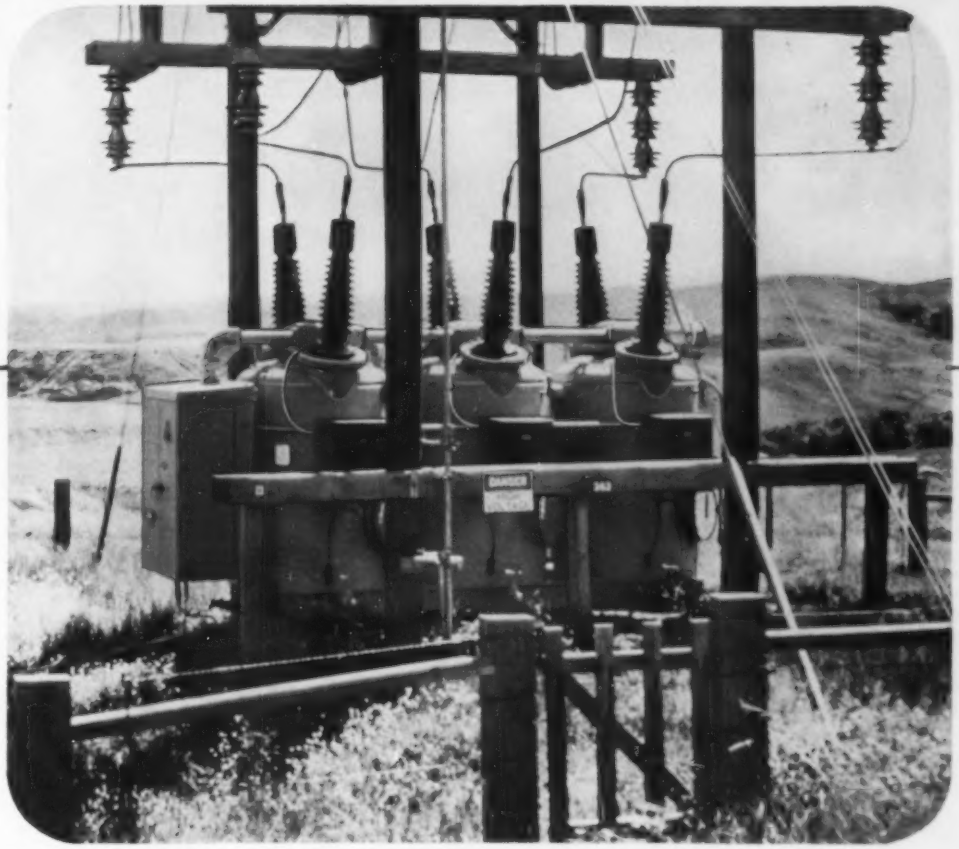
**Horizontal Mounting — Three Pole — Single Throw — Group Operated**

**SILVER TO SILVER CONTACTS**

**One Pole Shown**

**See Bulletin 46A**

# ON GUARD..."MILES FROM NOWHERE"



Federal Pacific RHE-64-H Circuit Breaker, 115 kv, 3500 mva, installed on the prairie, Garrison Dam, North Dakota

FEDERAL PACIFIC Circuit Breakers don't have to be regularly serviced and coddled... they're today's top specification for remote, unattended installations. Like the RHE-64-H Breaker at Garrison Dam, in North Dakota, large numbers of Federal Pacific Breakers are installed "miles from nowhere" and performing year after year with absolute dependability.

Federal Pacific Breakers have four big advantages that eliminate the need for scheduled maintenance:

★ Nothing operates except when the breaker operates;

★ Their energy requirements are extremely low;

★ With no power available, they can be operated by manually storing energy for full-speed closing;

★ They can be operated for extended periods of time, even without space heaters in sub-freezing temperatures.

• • •

Federal Pacific RHE Circuit Breakers are available in a range from 115 to 330 kv, 3 or 5 cycle opening-20 cycle reclosing, to 15,000 mva interrupting kva. For full information, write for Catalogs.

## FEDERAL PACIFIC ELECTRIC CO.

FORMERLY— FEDERAL ELECTRIC PRODUCTS COMPANY AND PACIFIC ELECTRIC MANUFACTURING CORP.

Main Office: 50 PARIS STREET, NEWARK 1, N. J.

**Federal Pacific products:** Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct, High voltage circuit breakers and power switches ★ Sales offices in principal cities.

# KUHLMAN BALANCED DESIGN PROVIDES A COORDINATED CORRELATION OF ALL DISTRIBUTION TRANSFORMER COMPONENTS

**CORE BALANCE (1)**—The Best Iron Core achieves the most desirable relation between the transformer, no load loss, and exciting current. It is the most efficient magnetic circuit in use today in distribution transformers.

**COIL BALANCE (2)**—A core of minimum cross section permits a more efficient use of copper in the coil windings.

**INSULATION BALANCE (3)**—Insulation between the turns, layers, and from windings to core and case are proportioned to the dielectric stresses encountered in service.

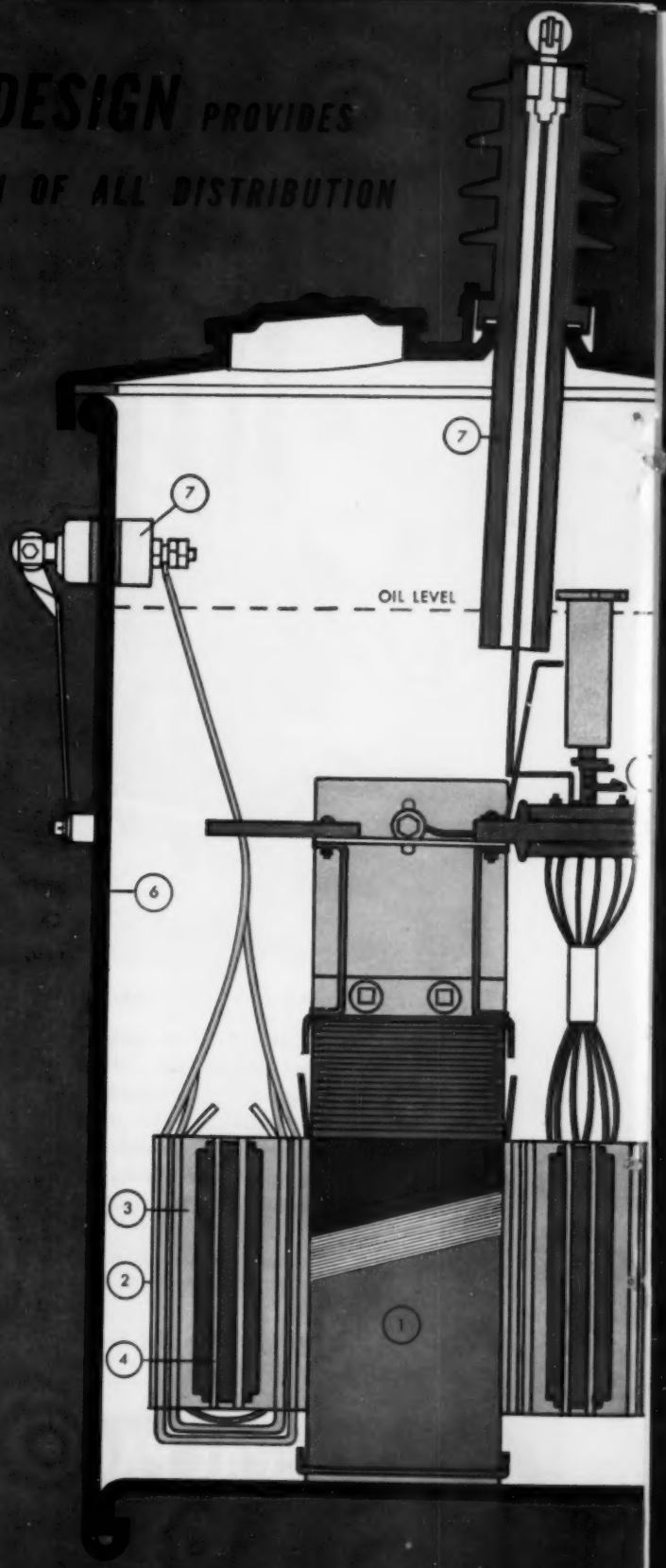
**THERMAL BALANCE (4)**—Coil structure makes efficient use of ducts and radiating surfaces for cool operation.

**TAP CHANGER BALANCE (5)**—Ease of operation and firm positive contacts are balanced against adequate insulation strength.

**TANK BALANCE (6)**—The tank's two functions as a container and a heat dissipator are balanced to obtain adequate radiation with minimum overall dimensions.

**BUSHING BALANCE (7)**—Flash-over, creepage, and puncture strength are coordinated with winding insulation.

"Balanced Design" in Kuhlman Transformers results in balanced performance of high efficiency and low voltage regulation.




KUHLMAN

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA